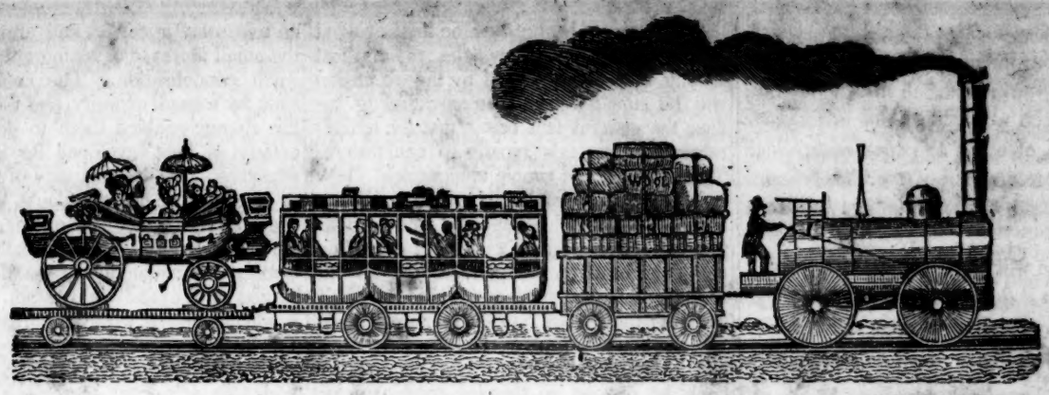

AMERICAN RAILROAD JOURNAL,
AND ADVOCATE OF INTERNAL IMPROVEMENTS.

PUBLISHED WEEKLY, AT NO. 30 WALL STREET, NEW-YORK, AT FIVE DOLLARS PER ANNUM, PAYABLE IN ADVANCE.

D. K MINOR, and GEORGE C. SCHAEFFER, } EDITORS AND PROPRIETORS.] SATURDAY, MARCH 25, 1837. [VOLUME VI—No. 12.

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AMERICAN RAILROAD JOURNAL.

NEW-YORK, MARCH 25, 1837.

REMOVAL.—The Office of the RAILROAD JOURNAL, NEW-YORK FARMER, and MECHANIC'S MAGAZINE, is removed to No. 30 WALL-STREET, *basement story*, one door from William street, and *opposite the Bank of America.*

☞ For List of Subscribers that have paid see page 191.

☞ For advertisement, "Rappahannock Canal, and Slack Water Navigation," see page 185.

We are requested to publish the following card, and we very cheerfully do so, as we published the report referred to—and hope ere long to lay before our readers the documents spoken of, from which it is probable the citizens of New-York will learn why the water works have progressed so tardily.—[EDS. R. R. J.]

A CARD.

The readers of the Water Commissioners' Report, published in the last number of the Railroad Journal, (March 18th) are respectfully informed that a series of Documents is in preparation, and shortly to be made public, in reply to the allegations contained in *that* and the *preceding* Report against the "late Chief Engineer." The community will thus be enabled to judge, by evidence the most authentic and unquestionable, of the *temper*, as well as the *regard*, for *truth* and *fairness*, in which these allegations have been made.

This duty would have been sooner performed, but it was not till within the last few days that the Report in which these charges are reiterated—though dated as early as the 9th of January—met the eye of the injured party. His motives for not noticing the subject at a still earlier date, he trusts will be righly appreciated.

New-York, 24th March, 1837.

RAILROAD AND CANAL STOCKS, in New-York and Philadelphia.

SALES OF STOCK IN NEW-YORK
March, 14th.

Mohawk Railroad	cash	79
Paterson Railroad	"	65
Boston and Providence	"	102½
New-Jersey Trans.	"	100
Stonington	"	69
Worcester Railroad	"	91
Long Island Railroad	"	74
Paterson Railroad	"	65
Stonington Railroad	"	69
Harlaem Railroad		66
Utica and Schenectady	cash	118½
Delaware and Hudson Canal	"	90
Morris Canal	"	95
New Orleans Canal	"	95

PHILADELPHIA STOCK MARKET.
March 17th.

	Price of shares	Offered	Asked
RAILROAD STOCKS			
New-Castle and Frenchtown	25	31½	32½
Do loan, 5½ per cent	100	99	101
Wilmington and Susquehanna	50	38	42
Camden and Amboy, shares,	100	134	136
Do loan, 6's 1836	100	110	120
Danville and P. shares	50	25	35
Norristown, do	50	33	33½
Do 6 per cent loan	100	85	100
Valley Railroad	7½	1	3
Westchester do	50	20	28
Minehill do	50	57	59
N. L. and Penn. Tp. do	40	34½	35
Philadelphia and Trenton do	100	125	127½
West Philadelphia Railroad	50	20	30
Harrisburg and Lancaster	50	46	48
Cumberland	25	15	20
Beaver and Meadow	50	57	57
MISCELLANEOUS STOCKS			
North American Coal Company	25	12	14
Steam Bt. Sts. Columbian	100	18	22
Exchange Stock	100	70	80
Arcade	100	55	75
Theatres—Chestnut street	600	625	675
———Walnut street	280	175	220
———Arch street	500	325	375
Gas Company	100	100	102
CANAL STOCKS.			
Schuylkill Navigation, shares	50	162	163
Do loans, 5 1843	100	98	100
Do do 1855	100	100	101
Do do 5½ 1837	100	98	100
Lehigh Coal and Navigation	50	82	83
Do loan, 6 1838	100	97	98
Do do 6 1839	100	97	98
Do do 6 1844	100	99	100
Do do 5 1840	100	96	97½
Union Canal, shares	200	180	190
Do loan, 1836	100	83	86
Do do 1840	100	85	90
Chesap'k & Delaware Canal, shares	200	20	40
Do loan, 1837	100	60	67
Do do 1849	100	60	67
Delaware and Hudson,	100	83	84
Do loan	100	95	100
Louisville and Portland	100	112½	117
Convertible 6 per cent. loans,	100	110	120
Sandy and Bever	100	60	80
Morris Canal	100	91	93

☞ It will not do, these hard times for money, to be too modest. The *Paper Maker* must be paid, the *Engraver*, the *Ink Maker*, and the *Printer* must be paid,—then why not Pay the Publishers and the Editors the *current year* and all *arrearages* for the Journal? *It must be done.*—PLEASE REMIT BY MAIL.

TRANSACTIONS OF THE INSTITUTION OF CIVIL ENGINEERS OF GREAT BRITAIN.

The first volume of this valuable work, has just made its appearance in this country. A few copies, say *twenty-five* or *thirty* only, have been sent out, and those have nearly or quite all been disposed of at *ten dollars* each—a price, although *not* the *value* of the work, yet one, which will prevent many of our young Engineers from possessing it. In

order therefore, to place it within their reach, and at a convenient price, we shall *reprint* the entire work, with all its engravings, *neatly done* on wood, and issue in six *parts* or *numbers*, of about 48 pages each, which can be sent to any part of the United States by mail, as issued, or put up in a volume at the close.

The price will be to subscribers *three dollars*, or *five dollars* for two copies—*always in advance*. The first number will be ready for delivery early in April—Subscriptions are solicited.

☞ Missing Numbers Wanted.—If any of our subscribers have numbers 4, 5, 6 and 7, of Volume or *five last* year, which they do not desire to preserve, they will confer a special favor by sending them to us, that we may complete a few copies of the volume.

*** If any of our subscribers are in want of *any other* number of the same volume to complete their volume they will please give early notice and they shall be sent.

The Title page and Index for last year, or volume five, will be forwarded to subscribers with our next number.

TRANSACTIONS OF THE INSTITUTION OF CIVIL ENGINEERS.

I. ON THE CHANGES OF TEMPERATURE CONSEQUENT ON ANY CHANGE IN THE DENSITY OF ELASTIC FLUIDS, CONSIDERED ESPECIALLY WITH REFERENCE TO STEAM. BY MR. THOMAS WEBSTER, M. A. OF TRINITY COLLEGE, CAMBRIDGE. COMMUNICATED BY MR. JAMES SIMPSON, M. INST. C. E.

My attention having been for some time directed to the theory and constitution of fluids, it has appeared to me that there are some properties of which little notice has been taken, but which, being of considerable practical importance, ought to receive the attentive consideration of scientific men, and especially of those who possess the opportunities of deciding on their value. On the present occasion I beg to offer a few observations respecting these properties. I wish, then, to call attention to the *change of temperature* which always accompanies a *change in the density* of an elastic fluid, and to the consequent change in the elastic force due simply to that change in temperature, as distinguished from the change which is due to the change of density according to the law of Boyle. It has long been observed, that the sudden compression of any quantity of air is attended with a great degree of heat, and its sudden expansion with a great degree of cold. Thus, if a piston, having a small piece of tinder attached to it, be pressed suddenly down in a cylinder of air or gas, the heat evolved, or squeezed out, by the compression will ignite the tinder; and again, if a delicate thermometer be placed under the receiver of an air-pump, it will indicate cold produced on every stroke of the pump. These effects will not continue long, since there will be an immediate transfer of heat, according to the well known laws of the radiation of heat; thus the heat evolved by the condensation will be rapidly lost among, and that absorbed by the expansion will be supplied from, the surrounding bodies, the general fact being, that the temperature always tends rapidly to equilibrium. The beautiful and simple apparatus of Gay-Lussac may be mentioned, since it exhibits at once both the phenomena in question. Let two spherical glass vessels communicate with each other by a stop-cock, and have a delicate thermometer suspended at their centres; then if one have the air exhausted, and the other be filled by a condenser, either with common air or with a gas, and the stop-cock be opened so that the condensed air rushes into the empty vessel, the thermometer in one vessel will sink and in the other will rise; namely, it will sink in that which is being emptied, or in which the air is expanding, and it will rise in that which is filling, or in which the air is being condensed; and when the experiment is made with great care, it will be seen that the cold indicated by one corresponds exactly to the heat indicated by the other. If another thermometer be suspended in the empty vessel close by the orifice, that is, just where the air is in the act of expanding, a very great degree of cold will be indicated; and this will diminish rapidly as it is placed further from the orifice. These indications of heat and cold continue but for a very short period, since the equilibrium of temperature is almost instantaneously restored. No accurate measure of the heat absorbed and developed can be procured by direct observations on the thermometer; it may, however, be calculated from the change in the elastic force, as we shall see presently. This experiment of Gay-Lussac does not appear to have been repeated on a large scale; but I conceive that if a large cylinder of thin metal were placed in communication with a vessel of condensed air at a great pressure, the cold produced at the one end, where the expansion was proceeding, and the heat produced at the other, where the condensation was taking place, would be quite sensible to the hand, and a series of air-thermometers would indicate very different states of temperature at the same distances from each end. But the important practical inquiry is the change which this developement and absorption of heat produces on the elastic force of the fluid; there must be increase of elastic force due to this increase of temperature, and a diminution of elastic force due to the diminution of temperature, besides the increase and diminution which is due to the change of density according to Boyle's law. In fact, we know that Boyle's law is not true, unless the compressed air is allowed time to cool, as was distinctly ascertained in the series of experiments made by order of the Academy of Paris on this subject. In the complete investigation of it by Desormes and Clements, which I have detailed at full length in my Theory of Fluids, Article 98, the increment of temperature is calculated by a series of mathematical reasoning, from this very change in the elastic force for which I contend. The problem proposed was "to determine the increment of temperature for a given small condensation." They observed the successive changes which the mercurial column underwent when air was first let into an exhausted receiver, and after it had lost the small increase of temperature due to the small condensation. The column always sunk by a small quantity, and the amount of this change enabled them to determine the amount of heat developed for a given condensation. Of the accuracy of their results there cannot be the least doubt, for two other and quite independent phenomena, in which the same causes are called into operation, namely, the production of sound and the vibration of a cylindrical column of air, give results according with very great accuracy. The preceding facts are mentioned, to give confidence in the principle for which I contend, that whenever there is a change in elastic force according to the law of Boyle due to the density, there is also an additional change in the elastic force due to the change of temperature, which is the necessary consequence of this change in the density: for it must be remembered, that in all the experiments, the elastic force agrees with the law of Boyle so soon as the equilibrium of temperature is restored.

On this part of the subject it is unnecessary to insist, since the facts are well established for most of the elastic fluids, but the experiments, so far as I have become acquainted with them, do not extend to steam, and unless there be some reason for excluding steam from the general properties of all other elastic fluids, we must admit the preceding conclusions with respect to it also. Now so far from having any reason to except steam from these laws, we have every reason for believing that steam separated from its water, and maintained at a higher temperature than 212°, differs in no respect from the permanent gases. It can be readily liquified, but doubtlessly all the gases can be reduced to the same form by a proper increase of pressure and diminution of temperature.

For if we consider steam as an elastic fluid owing its elastic qualities solely to the repulsive power of heat, there can be no reason *a priori* for excepting it from the laws of other elastic fluids, which appear to owe their energy and existence to the same cause. Now so far as experiments have been made, it appears that steam expands equally for all equal increments of temperature; thus following the law of other elastic fluids. There is a passage in Professor Robinson's Treatise on Steam which involves the principle in question, but which appears not to have been followed out. He says, "it is well "known that when air is suddenly expanded, "cold is produced, and heat when it is sud-"denly compressed. When making expe-"riments with the hopes of discovering the "connexion between the elasticity and den-"sity of the vapors of boiling water and "also of boiling spirits of turpentine, we "found the change of density accompanied "by a change of temperature vastly greater "than in the case of incoercible gases. "When the vapor of boiling water was "suddenly allowed to expand into five times "its bulk, we observed the depression of a "large and sensible thermometer to be at "least four or five times greater than in a "similar expansion of common air at the "same temperature."

The fact of the depression being greater in the expansion of steam than of air at the

same temperature, is explicable at once from the different constitutions of the two fluids with respect to the properties of heat; but on this I cannot at present enter. The fact is invaluable as coming from such a man, and, when viewed in connexion with the general theory of elastic fluids, and the above-mentioned law of Gay-Lussac respecting the expansion of steam for increments of temperature, entitles us to assume that, so long as steam retains its gaseous character, it is subject to the laws of gases. These conclusions might be sustained by many well known phenomena respecting vapors and evaporation generally, but enough has been said to warrant our including steam in the general law of the French philosophers respecting elastic fluids: "That equal volumes of "all elastic fluids, taken at the same tempe-"rature and the same pressure, being sud-"denly compressed or expanded by the "same fraction of their volume, disengage "or absorb the same absolute quantity of "heat."

Now the degree of heat or cold produced depends on the rate at which the change takes place; and this consideration will lead to some important conclusions with respect to the expansion of high-pressure steam. The rate of expansion will obviously depend on the elastic force of the steam; the higher pressure therefore which we use the greater will be the cold and the greater the diminution of the elastic force beyond that which the law of Boyle would give. Suppose steam of ten atmospheres suddenly to expand to four times its bulk, then the elastic force of the expanded steam ought, on these principles, to be much less than the elastic force of steam of five atmospheres suddenly expanded to twice its bulk; and the greater the elastic force of the steam, the greater will be the deviation from the law of Boyle. So that, while Boyle's law will be nearly true for steam of one or two atmospheres, it will be most untrue for steam of five or ten atmospheres. These, I conceive, are results which may be readily tested by careful experiments. I know of none in which they have been fairly examined, for I am not willing to admit the conclusions which may be drawn from some accounts of steam worked expansively, and which would appear to militate against these principles; but on this I shall say more immediately.

It would appear then, that the mere rate of expansion may be such, that the diminution of elastic force, consequent on the diminution of temperature, may leave scarcely any elastic force in the expanded steam; so that there may be extreme cases in which the law of Boyle will appear absolutely false. These conclusions appear to me supported and illustrated by the facts, that high pressure steam does not scald, and that elastic steam is not so efficacious as gunpowder for throwing bullets or other masses.

When low pressure steam expands into the air, it preserves very nearly both its density and its temperature, but when steam of a high pressure expands, the instantaneous augmentation of volume demands that a large portion of heat should become latent, or it cannot exist at all as steam. If the expansion were to stop the instant at which the elastic force of the steam becomes equal to that of the atmosphere, its temperature would (since the sum of the sensible and latent heat is invariable) descend only to 212°; but in consequence of the momentum which the particles have acquired from the rapidity of the expansion, it expands far beyond this limit, so that the diminution of temperature becomes greater, in proportion as its original elastic force was greater than the elastic force of the atmosphere. If this expansion takes place in a vacuum, the reduction of temperature will be greater still, since the particles of air present mechanical obstacles to the expansion. So that in some cases the elastic force may be lost almost entirely. We know, thanks to the ingenuity of Mr. Perkins, that highly elastic steam will impel bullets with considerable velocity; this velocity does not, however, appear to be equal to that which can be generated by gunpowder. Now in order to increase the velocity, we must increase the elastic force of the steam, the consequence of which being an increased rapidity of expansion, the additional reduction of temperature may more than nullify the original increase of elastic force, so that steam at a higher pressure will be less efficacious than steam of a less pressure. If this be the case, there is some temperature at which for a given ball the effect is a maximum, that is, greater than either at a higher or a lower temperature. But in the case of gunpowder the temperature of the elastic fluid is kept up by the continued consumption of fresh materials; the heat evolved during the combustion of these ingredients is quite prodigious, so that we have, in fact, the repulsive power of heat itself in full agency. I have said nothing respecting the density of the steam at different temperatures, my object not being to discuss this question fully, but merely to illustrate what must, I conceive, be the necessary consequence of increasing the temperature and elasticity of the steam beyond certain limits.

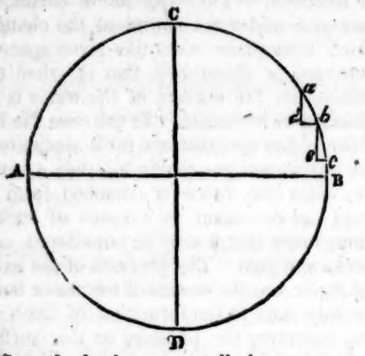
The application of these principles to the working of *steam expansively* is at once apparent; there will in every case be a diminution in the pressure exerted beyond what will be given by Boyle's law, and this will be greater the more rapidly the engine is worked. But on this subject I hardly dare venture any remarks; practical considerations are of much greater value than any which I can offer, especially as in one large class of engines, namely, in condensing engines, where the steam is worked at a low pressure, the deviations from the Boylean law, due to the cause which I have mentioned, cannot be considerable; still, however, these deviations must, I conceive, be appreciable whenever the steam is generated at a higher temperature than 212°. But in high pressure engines the deviations due to this cause must be considerable, and I would venture to suggest that if higher pressure steam be used than is from the circumstances of the case practically necessary, the steam generated is not applied in the most economical manner, so far as concerns the ratio of the work done to the fuel consumed. The preceding remarks have referred exclusively to steam separated from its water and maintained at such a temperature that it may be considered as a permanent gas. If the steam be not separated from its water, the case is so entirely different, that the preceding remarks do not at all apply.

If the space above the water be not saturated with vapor, that is, if the vapor which it contains have not the maximum density due to the temperature of the water, it is owing to the mechanical obstruction of the particles of air; but since we suppose the air removed, or the space full of steam, we have to consider the nature of the changes which take place when this given space is increased or diminished, that is, when the pressure on the surface of the water is diminished or increased. In this case the law of Boyle has no existence, for it applies only to a permanent gas, that is, it is only a steam law, when the vapor is detached from its liquid and contained in a space of such a temperature that it may be considered as a permanent gas. The pressure of the existing vapor on the surface of the water being the only limit to the formation of fresh vapor, whenever the pressure on this surface is diminished in the boiler by the withdrawal of a portion of the steam, fresh steam will instantly be formed, so that if, where steam is worked expansively, there be any water at the bottom of the cylinder, or any communication whatever with any water, the effect will be precisely the same as if the communication with the boiler were not entirely cut off; there will be a constant accession of steam, or fresh steam will be formed as fast as the piston rises. It has sometimes been stated that where steam is worked expansively, the effect is greater than the Boylean law would lead us to suppose; if such appear to be the case, it must be from some such cause as the above mentioned; either the steam is not entirely cut off, or there is some communication with water: the smallest quantity of water will be sufficient to increase very considerably the apparent effect, and cause a great deviation from the calculated elastic force. The whole theory of this subject is so intimately connected with the theory of heat, that the consequence of its known laws may be immediately traced in every application of steam; hence we may be convinced that there is a loss of elastic force, besides that which is due to the change in density, whenever steam is worked expansively, however much it may be practically overruled and modified. As a means of detecting this I would mention, that it ought to be shown by the greater supply of heat which a cylinder requires when the steam is worked more expansively, than where the same steam is worked less expansively. From these considerations we may see that there is a maximum in the useful effect of expansion working; but the complete determination of it is a purely practical question, and since it will depend on the conducting power of the metal, it must be somewhat different for every different engine.

II. ON THE FORCE EXCITED BY HYDRAULIC PRESSURE IN A BRAMAH PRESS; THE RESISTING POWER OF THE CYLINDER, AND RULES FOR COMPUTING THE THICKNESS OF METAL FOR PRESSES OF VARIOUS POWERS AND DIMENSIONS. BY PETER BARLOW, F. R. S. ETC., OF THE ROYAL MILITARY ACADEMY.

I am not aware that any of our writers on mechanics have investigated the nature and amount of the circumferential strain which

is excited in an hydraulic cylinder by a given pressure on the fluid within; it will be proper, therefore, first to examine this question: viz., to find the circumferential strain on a ring of any material, arising from an internal pressure.



Let *ab*, *bc*, be any small elementary part of the circumference, which may be taken as right lines, and let the pressure on each of them be called *p*, which, being proportional to them, may be represented by the elements themselves, *ab*, *bc*, these being perpendicular to the direction in which the pressure acts. Resolve these pressures or forces into two rectangular forces, *ad*, *db*, *be*, *ec*, of which, *ab*, and *be*, will represent forces acting perpendicular to their direction or parallel to A B, and *db* and *ec* forces parallel to D C. Confining ourselves at present to the former, if we conceive the semi-circumference D B C to be divided into its component elements, it is obvious that the sum of the forces acting parallel to A B, will be equal to the sum of all the perpendiculars, *ad*, *be*, or to the whole diameter D C. That is, the sum of all the forces acting parallel to A B, will be to the sum of all the forces or pressure on the semi-circumference D B C, as the diameter to the semi-circumference. But the pressure on the semi-circumference is equal to the number of inches in the same, multiplied by the pressure per square inch, consequently the force or pressure exerted parallel to A, B, will be equal to the inches in the diameter, multiplied by the pressure per square inch, the ring being here supposed, for the purpose of simplification, only an inch deep. But to resist this pressure, we have the two thicknesses of the ring at D and C; therefore the direct strains on the circumference at any one point, as D, will be equal to the pressure of the fluid per square inch, multiplied by the number of inches in the radius.

We should come to the same result more simply, but perhaps not so satisfactorily, by conceiving a section passing through the diameter D C; then it follows that the pressure on this section, which is directly resisted at D and C, is equal to the number of square inches in the section, multiplied by the pressure per square inch. Therefore the strain on D or C singly, is equal to the pressure per square inch multiplied by the inches in the radius; the same as above.

TO INVESTIGATE THE NATURE OF THE RESISTANCE OPPOSED BY ANY GIVEN THICKNESS OF METAL IN THE CYLINDER OR RING.

It would appear at first sight, that having found the strain at D and C, it would only be necessary to ascertain the thickness of metal necessary to resist this strain when applied directly to its length; this, however is by no means the case, for if we imagine, as we must do, that the iron, in consequence of the internal pressure, suffers a certain degree of extension, we shall find that the external circumference participates much less in this extension than the interior, and as the resistance is proportional to the extension divided by the length, according to the law *ut tensio sic vis*, it follows, that the external circumference, and every successive circular lamina, from the interior to the exterior surface, offers a less and less resistance to the interior strain: the law of which decrease of resistance it is our present object to investigate.

In the first place, it is obvious that whatever extension the cylinder or ring may undergo, there will be still in it the same quantity of metal, or which is the same, the area of the circular ring, formed by a section through it, will remain the same, which area is proportional to the difference of the squares of the two diameters.

Let D be the interior diameter before the pressure is exerted, and $D+d$ its diameter when extended by the pressure. Let also D' be the external diameter before, and $D'+d'$ the diameter after the pressure is exerted; then from what is stated above it follows, that we shall have

$$D'^2 - D^2 = (D'+d')^2 - (D+d)^2$$

or, $2D'd' + d'^2 = 2Dd + d^2$

or, $2D' + d' : 2D + d :: d : d'$

or since d' and d are very small in comparison with D' and D, this analogy becomes $D' : D :: d : d'$. That is, the extension of the exterior surface is to that of the interior as the interior diameter to the exterior.

But the resistance is as the extension divided by the length, therefore the resistance of the exterior surface is to that of the interior as $\frac{D}{D'} : \frac{D'}{D}$ or as $D^2 : D'^2$. That is the resistance offered by each successive lamina, is inversely as the square of the diameter, or inversely as the square of its distance from the centre; by means of which law the actual resistance due to any thickness is readily ascertained.

Let *r* be the interior radius of any cylinder, *p* the pressure per square inch on the fluid, *t* the whole thickness of the metal, and *x* any variable distance from the interior surface. Let also $rp = s$ represent the strain exerted at the interior surface, according to the principles explained in the preceding part of this paper. Then by the law last illustrated we shall have

$(r+x)^2 : r^2 :: s : \frac{r^2 s}{(r+x)^2}$ for the strain at the distance *x* from the interior surface:

and consequently $\int \frac{r^2 s dx}{(r+x)^2} + \text{Cor.} =$ the sum of all the strains, or the sum of all the resistance. This becomes, when $x=t$, $R = r^2 s \left(\frac{1}{r} - \frac{1}{r+t}\right) = s \frac{rt}{r+t}$. That is, the sum of all the variable resistances due to the whole thickness *t*, is equal to the resistance that would be due to the thickness $\frac{rt}{r+t}$ acting uniformly with a resistance *s*, or *rp*.

APPLICATION OF THIS RULE FOR COMPUTING THE PROPER THICKNESS OF METAL IN A CYLINDRIC HYDRAULIC PRESS OF GIVEN POWER AND DIMENSIONS.

Let *r* be the radius of the proposed cylinder, *p* the pressure per square inch on the fluid, and *x* the required thickness: let also *c* represent the cohesive strength of a square inch rod of the metal.

Then from what has preceded it appears, that the whole strain due to the interior pressure will be expressed by *px*, and that the greatest resistance to which the cylinder can be safely opposed is $c \times \frac{rx}{r+x}$: hence when the strain and resistance are in equilibrio, we shall have

$$(1) \quad rp = \frac{rx}{r+x} \times c$$

or $pr + px = cx$

whence $x = \frac{pr}{c-p}$ (the thicknes) sought.

Hence the following rule in words for computing the thickness of metal in all cases; viz., multiply the pressure per square inch by the radius of the cylinder, and divide the product by the difference between the cohesive strength of a square inch rod of the metal and the pressure per square inch, and the quotient will be the thickness required.

At present we have only considered the circumferential strain: to find the longitudinal strain, we have to multiply the area of the piston by the pressure per inch; while the resistance in this direction will be equal to the cohesive power of the metal multiplied by the area of the transverse section of the cylinder; so that when these are equal to each other we shall have

$$(2) \quad 3{\cdot}1416\, r^2 p = 3{\cdot}1416\, (2rx + x^2)c$$

which gives $x = r \left\{ \sqrt{\left(\frac{p}{c} + 1\right)} - 1 \right\}$

And it is obvious that whichever of these two values of *x*, viz., (1) or (2,) is the greatest, is the one which must be adopted. It will appear, however, that in all practical cases the former is the greater; for it is only when *p* exceeds *c* that the latter value of *x* can be ever equal to the former. Let us, for example, find the relative values of *p* and *c*, when these values of *x* are equal to each other, by making

$$\frac{rp}{c-p} = r \left\{ \sqrt{\left(\frac{p}{c} + 1\right)} - 1 \right\}$$

this gives

$$\frac{p^2}{(c-p)^2} + \frac{2p}{c-p} = \frac{p}{c}$$

or $p^2 c + 2pc\,(c-p) = p\,(c-p)^2$

or $p^2 - pc = c^2$

whence $p = c\,(\frac{1}{2} \pm \frac{1}{2}\sqrt{5})$

That is, these two values of *x* can only be equal to each other when *p* exceeds *c* in the ratio of $(\frac{1}{2} \pm \frac{1}{2}\sqrt{5}) : 1$; which is an impracticable pressure; for it is obvious from the first value of *x*, that no thickness will be sufficient to resist an internal pressure which exceeds (per square inch) the cohesive power of a square inch rod of the metal; a result which at first sight appears to be paradoxical; but it will be observed that, with such a pressure, the interior sur-

face will be fractured before the other parts of the metal are brought into action.

It will therefore be sufficient to attend wholly to the first expression; and here it may be observed that x and r, with the same pressure and cohesive power, being always in the same ratio, we may reduce the rule for finding the thickness of metal to the following tabulated form, in which it will only be necessary to mutiply the number standing against any pressure by the internal diameter of the cylinder or piston for the thickness required.

The cohesive strength of cast iron, according to experiments made at Capt. Brown's manufactory, is 7·26 tons per square inch; but his machine underrates its power 8 per cent.; (see my Essay on the Strength of Wood and Iron, page 258, 2d edition;) this added, gives us 7·86 tons, or 17,612 lbs., per square inch.

Mr. Rennie gives two results for the cohesive power of cast iron, viz.,

1st . .	= 18,656
2d . .	= 19,072
My experiment	= 17,612
Mean . .	= 18,685

We may, therefore, without sensible error, call the cohesive power 18,000 lbs. per square inch.

The cohesive power of the best gun-metal is given by Mr. Tredgold, in his edition of Buchanan's Treatise on Mill Work, 36,000 lbs. per square inch, and that of lead, 3328 lbs. per sq. inch; and with these numbers I have computed the following thickness for pipes of an inch diameter, for the various pressures given in the Tables, and which will apply to any other case by multiplying the tabular numbers by any given diameter.

TABLE FOR COMPUTING THE THICKNESS OF CAST IRON PIPES AND CYLINDERS.

COHESIVE STRENGTH OF CAST IRON, 18,000 lbs.							
PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.
1000	·0294	2000	·0625	3000	·1000	4000	·1438
1100	·0325	2100	·0660	3100	·1040	4500	·1666
1200	·0357	2200	·0696	3200	·1080	5000	·1922
1300	·0388	2300	·0732	3300	·1122	5500	·2200
1400	·0421	2400	·0769	3400	·1164	6000	·2499
1500	·0454	2500	·0806	3500	·1207	6500	·2827
1600	·0487	2600	·0844	3600	·1250	7000	·3181
1700	·0521	2700	·0883	3700	·1293	7500	·3570
1800	·0555	2800	·0921	3800	·1337	8000	·4000
1900	·0590	2900	·0959	3900	·1382	8500	·4462

TABLE FOR COMPUTING THE THICKNESS OF GUN-METAL CYLINDERS; APPLICABLE ALSO TO GUNS AND MORTARS.

COHESIVE STRERGTH OF GUN-METAL, 36,000 lbs.							
PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.
1000	·0143	2000	·0294	3000	·0454	4000	·0625
1100	·0157	2100	·0309	3100	·0471	4500	·0714
1200	·0172	2200	·0325	3200	·0487	5000	·0806
1300	·0187	2300	·0341	3300	·0504	5500	·0901
1400	·0202	2400	·0357	3400	·0521	6000	·1000
1500	·0217	2500	·0372	3500	·0538	6500	·1102
1600	.0232	2600	·0388	3600	·0555	7000	·1207
1700	·0247	2700	·0405	3700	·0572	7500	·1315
1800	·0263	2800	·0421	3800	·0590	8000	·1428
1900	·0278	2900	·0438	3900	·0607	8500	·1543

TABLE FOR COMPUTING THE THICKNESS OF LEAD CYLINDERS, WATER PIPES, ETC.

COHESIVE STRENGTH OF SHEET LEAD, 3320 lbs.					
PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.	PRESSURE.	THICKNESS.
5	·00075	100	·0155	1100	·2477
10	·001510	200	·0320	1200	·2830
20	·003030	300	·0496	1300	·3217
30	·004559	400	·0684	1400	·3645
40	·006097	500	·0886	1500	·4120
50	·007645	600	·1102	1600	·4651
60	·009202	700	·1335	1700	·5246
70	·010769	800	·1587	1800	·5921
80	·012345	900	·1859	1900	·6690
90	·013931	1000	·2155	2000	·7575

For a pressure not found in any of the above Tables, it will be sufficiently correct to use the following proportion, viz:

As the difference of the two tabular pressures, between which the given pressure falls; is to the difference between the corresponding tabular thickness, so is the difference between the lesser tabular pressure and the given pressure, to the difference between the lesser tabular thickness and that required. Suppose, for example, the thickness for a cast iron cylinder were required for a pressure of 3650 lbs.

Pressure	3700	Thickness	·1293
Do.	3600	Do.	·1250
Difference	100	Difference	·0043

100 : ·0043 :: 50 : ·0021

Therefore	·1250
	·0021
	·1271 the thickness sought.

As another example of the use of the Table, let the thickness of a cast iron cylinder be required, that will bear a proof pressure of 3 tons per circular inch, the interior diameter being 12 inches.

Here $\frac{3 \text{ tons}}{\cdot 7854} = 3 \cdot 819$ tons or 8551 lbs. per square inch. Call this 8500 lbs.; then, by Table I., the thickness for an inch cylinder is ·4462, consequently $4462 \times 12 = 5 \cdot 3544$ inches, the thickness required.

It will of course be understood that the thicknesses given in the Table are the least that will bear the required pressure, and that, in common practice, presses ought not to be warranted to bear above one third the pressure given in the Table, unless it should appear that the estimated cohesive power of cast iron is too little; if this actually exceed 18,000 lbs., a corresponding reduction may be made in the computed thicknesses.

ON THE HOT AIR BLAST. BY MR. J. B. NEILSON, COR. MEM. INST. C. E. COMMUNICATED IN A LETTER TO THE LATE PRESIDENT, THOMAS TELFORD, Esq.*

I feel much pleasure in being able to comply with your request in mentioning to you what I conceive to be the nature of the advantages likely to be derived by the Iron Trade, and the country generally, from my invention of the Hot Blast, and at the same time, I shall very willingly state the circumstances, agreeably to your request, which, in the first instance, led me to direct my attention to the improvement of the process of iron-making.

About seven years ago, an iron-maker, well known in this neighborhood, asked me if I thought it possible to purify the air blown into blast furnaces, in a manner similar to that in which carburetted hydrogen gas is purified; and from this gentleman's conversation, I perceived that he imagined the presence of sulphur in the air to be the cause of blast furnaces working irregularly, and making bad iron in the summer months. Subsequently to this conversation, which had in some measure directed my thoughts to the subject of blast furnaces, I received information that one of the Muirkirk iron furnaces, situated at a considerable distance from the

* Although the application of heated air has been extended, and the subject tereated more at large since this paper was written, the detail of the discovery from Mr. Neilson to the late President, cannot fail to be interesting. In a future volume, the Council trust to be able to add a further communication from that gentleman on the subject.

engine, did not work so well as the others; which led me to conjecture that the friction of the air, in passing along the pipe, prevented an equal volume of the air getting to the distant furnace, as to the one which was situated close by the engine. I at once came to the conclusion that by heating the air at the distant furnace, I should increase its volume in the ratio of the known law, that air and gases expand as 448 + temperature.

Example.—If 1000 cubic feet, say at 50° of Fahrenheit, were pressed by the engine in a given time, and heated to 600° of Fahrenheit, it would then be increased in volume to 2104·4, and so on for very thousand feet that would be blown into the furnace. In prosecuting the experiments which this idea suggested, circumstances however became apparent to me, which induced the belief on my part, that heating the air introduced for supporting combustion into air furnaces, materially increased its efficiency in this respect; and with the view of putting my suspicions on this point to the test, I instituted the following experiments.

To the nozzle of a pair of common smith's bellows, I attached a cast iron vessel heated from beneath, in the manner of a retort for generating gas, and to this vessel, the blow-pipe by which the forge or furnace was blown, was also attached. The air from the bellows having thus to pass through the heated vessel above mentioned, was consequently heated to a high temperature before it entered the forge fire, and the result produced, in increasing the intensity of the heat in the furnace, was far beyond my expectation, and so evident as to make apparent to me the fallacy of the generally received opinion, that the coldness of the air of the atmosphere in the winter months, was the cause of the best iron being then produced.

In overthrowing the old theory, I had however established new principles and facts in the process of iron-making, and by the advice and assistance of Charles M'Intosh, Esq., of Crossbasket, I applied for and obtained a patent, as the reward of my discovery and improvements.

Experiments on the large scale to reduce iron ore in a founder's cupola, were forthwith commenced at the Clyde Iron Works, belonging to Colin Dunlop, Esq, which experiments were completely successful, and in consequence, the invention was immediately adopted at the Calder Iron Works, the property of William Dixon, Esq.; where the blast being made to pass through two retorts placed on each side of one of the large furnaces, before entering the furnace, effected an instantaneous change, both in the quantity and quality of iron produced, and a considerable saving of fuel.

The whole of the furnaces at Calder and Clyde Iron Works were in consequence immediately filled up on the principle of the Hot Blast, and its use at these works continues to be attended with the utmost success; it has also been adopted at Wilsontown and Gartshirrie Iron Works in Scotland, and at several works in England and France, in which latter country I have also obtained a patent.

The air as at first raised to 250° of Fahrenheit, produced a saving of three-sevenths in every ton of pig-iron made, and the heating apparatus having since been enlarged, so as to increase the temperature of the blast to 600° Fahrenheit and upwards, a proportional saving of fuel is effected; and an immense additional saving is also acquired by the use of raw coal instead of Coke, which may now be adopted. By thus increasing the heat of the blast, the whole waste incurred in burning the coal into coke is avoided in the process of iron-making.

By the use of this invention, with three-sevenths of the fuel which he formerly employed in the cold air process, the iron-maker is now enabled to make one-third more iron of a superir quality

Were the Hot Blast generally adopted, the saving to the country in the article of coal, would be immense. In Britain, about 700,000 tons of iron are made annually of which 50,000 tons only are produced in Scotland; on these 50,000 tons, my invention would save in the process of manufacture, 200,000 tons of coal annually. In England, the saving would be in proportion to the strength and quality of the coal, and cannot be computed at less than 1,520,000 tons annually; and taking the price of coals at the low rate of four shillings per ton, a yearly saving of £ 296,000 sterling would be effected.

Nor are the advantages of this invention solely confined to iron-making: by its use the founder can cast into roods an equal quantity of iron, in much less time, and with a saving of nearly half the fuel employed in the cold air process; and the blacksmith can produce in the same time one-third more work, with much less fuel than he formerly required.

In all the processes of metallurgical science, it will be of the utmost importance in reducing the ores to a metallic state.

V. AN APPROXIMATIVE RULE FOR CALCULATING THE VELOCITY WITH WHICH A STEAM VESSEL WILL BE IMPELLED THROUGH STILL WATER, BY THE EXERTION OF A GIVEN AMOUNT OF MECHANICAL POWER, OR FORCIBLE MOTION, BY MARINE STEAM ENGINES. COMMUNICATED BY MR. FAREY, M. INST. C. E.

Notwithstanding the great experience which has been acquired in constructing steam vessels, few engineers possess any rule for determining *a priori*, what will be the speed of a new vessel, which is designed.

The usual course is, to institute to a comparison with some former steam vessel, whereof the dimensions and performance is known, and by estimating all the differences of dimensions between that former vessel, and the new-intended one, the difference of its expected performance from the known performance, is inferred. When the new intended vessel is not materially different from some previously known case, this method of comparison answers the purpose; but so many cases arise in practice, which are not comparable with any known case, that a general rule is greatly wanted, and the writer of this communication has kept the subject in view, from the first establishment of steam vessels till the present time, omitting no opportunity of ascertaining and recording the performance of every steam vessel whereof the form and dimensions could be ascertained, and at intervals arranging the observations in classes, and deducing rules from them, which have been amended and improved from time to time, as more complete information was attained.

Almost all experiments which have been made, on the resistance of drawing floating bodies, along the surface of unconfined, but tranquil water show, that the resistance increases as the square of the velocity; and hence it may be inferred, that if the draft, or direct pull, (such as horses exert on the towing line of a canal boat,) which is requisite to draw a vessel along the water at a rate of five miles per hour, is one ton, then to draw it at the rate of ten miles per hour, will require a pull of four tons.

It follows as a consequence, that the exertion of mechanical power, or forcible motion, must progress according to the cubes of the velocities, because an increased force is to be exerted with an equally increased velocity; for instance, if an exertion of 25 horse power will impel a given vessel at the rate of five miles per hour, it would require an exertion of 200 horse power, to impel the same vessel at the rate of ten miles per hour.

These two propositions are to be considered as assumptions, when applied to steam vessels, because the experiments on which the first is founded, viz., the rate of resistance being as the square of the velocity, have been all made on very small vessels, nevertheless they all concur in very nearly the same result*; and again, in steamboats, the water yields very considerably to the paddles, and a loss of power is thereby occasioned,† which is not con-

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* A fund of valuable information on this subject is contained in the papers of the late Colonel Beaufoy. Since the above was written, those papers have been published by his son in a quarto volume, which has been distributed in the scientific world; a copy is preserved in the library of the Institution.

† This loss had formerly a much greater influence than at present; because the improvements which have been made in proportioning the paddles of modern steam boats, has rendered the loss less considerable. I was formerly induced to suppose that the exertion of power increased by a higher ratio than the cubes of the velocities attained by the exertion. This notion arose in the course of some of my earliest deductions, from observations on the steamboats first used in Scotland; comparing their increase of speed with the power exerted by successive engines, of greater and greater magnitude, which were substituted one after another on board the same boats, it appeared that the exertion of power required to produce different velocities, corresponded to some intermediate stage between the cubes and the biquadrates of those velocities; an arithmetical mean between the cube and the biquadrate seemed nearly to correspond to those observations, but subsequently it was found out, that the loss occasioned by the yielding of the water

templated in framing the second proposition, (viz. that the power exerted must be as the cube of the velocity, because the resistance of draft is as the square of the velocity.)

Notwithstanding any doubts which may be entertained of the exactitude of the last proposition, the following rule (which proceeds on the assumption, that the impelling power which must be exerted, is as the cube of the velocity) will be found to give results which approximate to the actual performance of steam vessels in common use.

The rule contemplates the extent of surface which the bottom of the vessel exposes to contact with the water, and also the sectional area of the water which must be divided by the vessel, in advancing forwards; and numbers representing those two quantities, are combined into one sum, which is taken to represent the resistance of the vessel, compared with any other vessel of a different magnitude, but similar in form, the speed in both cases being equal.

In estimating the power exerted by the engines, the rule supposes the actual power, as shown by the indicator, with due allowance for friction, not the nominal power by which the engines are rated, which in modern engines is always very much less than the power actually exerted. For instance,

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to the paddles, had been very greatly increased when larger engines had been first substituted for smaller engines, but when larger paddle wheels, and paddles, were given to the larger engines, the speed was improved, and when so improved the power exerted came out nearly as the cubes of the velocities.

This notion would be no more worthy of being recorded than a multitude of other attempts to deduce rules from uncomparable observations, if a rumor of it had not, unknown to me, found its way into a memoire upon navigation by steam, read before the institution at Paris in 1826, by M. Seguin, who relates that he consulted me, when I resided at Leeds, and that I considered the resistance of vessels to be proportional to the fifth powers, divided by the cubes of the velocities, which Mr. Seguin says confirmed some opinions of his own.

Now the fifth power of any number being divided by the cube thereof, is only the same as the square of the number, and that is the proportion of force of draft, which I have always assumed to be requisite for overcoming the resistance of pulling a vessel through the water, with different velocities; but the mechanical power, or forcible motion, which must be exerted by a steam engine, in order to overcome that resistance, I assume to be as the cubes of those velocities; I explained to Mr. Seguin, that formerly I had supposed it to be a more rapid rate of increase than the cubes, something like an arithmetical mean between the cube and the biquadrate as above stated. The fifth power divided by the cube, was a statement made to me, and to which I assented, as giving correct results for the resistance of draft; but it is a needlessly complicated mode of expressing the square of a number. J. F.

Messrs. Boulton, Watt, and Co.'s marine engines, are calculated to exert about $7\frac{3}{10}$ lbs. effective force, for each square inch of their pistons, and the motion of the pistons in their cylinders causes an expenditure of $31\frac{1}{10}$ cubic feet of steam per minute, for every nominal horse power,* being a little different from their scale for land engines.

Messrs. Boulton, Watt, and Co.'s 50 horse marine engines, have cylinders $39\frac{1}{2}$ inches diameter, their pistons moving $3\frac{1}{2}$ feet stroke, and are calculated to make $26\frac{1}{2}$ strokes per minute. Their 80 horse marine engines, have cylinders $47\frac{1}{2}$ inches diameter, pistons $4\frac{1}{2}$ feet stroke, and calculated at $22\frac{1}{2}$ strokes per minute.

When a trial of any modern marine engine is made by an indicator, the effective or unbalanced pressure of steam, by which the piston is impelled, will be found much more than the assumed $7\frac{3}{10}$ lbs. per square inch, after allowing amply for friction; $11\frac{1}{2}$ lbs. per square inch is probably nearer to an average of good engines; but the very best are considerably more, even as much as $12\frac{1}{2}$ lbs. per square inch. The actual power exerted, will be greater than the nominal horse power, in proportion as the actual force exerted by the piston is greater than the assumed standard of $7\frac{3}{10}$ lbs. per square inch.

The approximate rule is as follows:—

I. Find the area of the transverse section of the vessel, under water, in square feet; extract the square root of that number of square feet; multiply the root by the length of the vessel at the water's surface, and divide the product by the greatest breadth of the vessel at the water's surface; then add the quotient to the above number of square feet; the sum is to be taken for a representation of the resistance of the vessel, compared with others of different sizes, but similar in form, the comparison being made, by the above mode of computation, when they are proceeding with the same velocity.

II. Find the number of horse powers actually exerted by the engines, according to observations made by the indicator, and multiply that number by 1000, in case of vessels of an ordinary form, such as were usually built for sea-going vessels seven years ago†; divide the product by the number previously found as above; then extract the cube root of the quotient; and that root will be near to the velocity of the vessel, in miles per hour, through still water.

Example, of a large vessel, 150 feet long, 27 feet broad, drawing $9\frac{1}{2}$ feet water, impelled by two engines rated at 80 horse power each; she went $9\frac{7}{10}$ miles per hour (in 1826).

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* That horse power being in all cases, according to Mr. Watt's standard, a force of 33,000 lbs. acting through a space of one foot per minute.

† For the very full built forms, such as were used for the early steam boats, built more than 14 years ago, the multipliers should be only 900; or for the very sharp improved forms built in the last two or three years, 1100.

The sectional area of the part under water, was 207.6 square feet; the square root of that is 14.4, which multiplied by 150 feet long, and the product divided by 27 feet broad, gives 80 for a representation of the surface of the bottom in contact with the water, and that added to 207.6 square feet, gives 287.6 to represent resistance. The engines were found by the indicator, to exert an effective force of $11\frac{1}{2}$ lbs. per square inch of their pistons, (friction being allowed for,) when they made 23 strokes per minute, of $4\frac{1}{2}$ feet; the pistons being $47\frac{1}{2}$ inches diameter; that is, 128 horse power, actually exerted by each engine, or 256 horse power by both, this being multiplied by 1000, gives 256,000, which product divided by 287.6 gives 890; and the cube root thereof is 9.62 miles per hour, instead of 9.7 miles, as observed.

Another example, of a small vessel, 105 feet long, $17\frac{1}{2}$ feet broad, drawing $5\frac{1}{2}$ feet of water, impelled by one engine, rated at 50 horse power; she went $9\frac{3}{4}$ miles per hour (in 1829.)

The sectional area was 62 square feet: square root thereof 7.87×105 feet long $\div$ $17\frac{1}{2}$ feet broad=47.25, to be added to 62, making 109.25 to represent resistance. The piston, according to the indicator exerted $12\frac{1}{2}$ lbs. per square inch effective force, (after allowing for friction,) and made 30 strokes per minute of $3\frac{1}{2}$ feet, piston $39\frac{1}{2}$ inches diameter, that is, an exertion of $97\frac{1}{2}$ horse power; multiply that by 1000, and divide by 109.25, gives 892, the cube root of which is 9.626 miles per hour.

The above two vessels being the same in speed, but very different in magnitude, the accordance of the results given by the rule with the facts, shows that the rule makes a proper allowance for difference of magnitude.

Another example, of a small boat, 72 feet long, 15 feet broad, a very full built form, impelled slowly, by one engine of the oldest construction, called 10 horse power, made in Scotland, 1814.

Sectional area 42 square feet; square root thereof 6.48×72 feet long $\div$ 15 feet broad=31.1, to be added to 42, making 73.1 to represent resistance. The engine was very inferior to the modern ones*, and probably did not exert above $7\frac{1}{2}$ lbs. per square inch of the piston, which was 22 inches diameter, 2 feet stroke, and made 32 strokes per minute, that would be 11.1 horse power. The form of this old boat being very round at the bows, and more resisting than the modern vessels, should have a lower multiplier, viz. 900 instead of 1600; therefore 11.1 horse power $\times$ $900 \div 73.1$ resistance, gives 136.7; the cube root of which is 5.15 miles per hour, which was very near the real speed of this boat.

Another example, of an old boat, 156 feet long, 33 feet broad, in America, 1816, im-

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* In those older examples previous to 1819, wherein no indicator observations were made upon the engines, the probable force exerted by the pistons, has been inferred from indicator observations, made since, upon other engines of similar structure and proportions of their parts.

pelled by one engine, piston 40 inches diameter, 5 feet stroke, 17 strokes per minute. she went 6½ miles per hour. Sectional area 150 square feet; square root 12.25 × 156÷33=57.9 to be added to 150=207.9 for resistance; the piston probably exerted about 9½ lbs. per square inch, which would be 61.5 horse power*. The form of this boat being very full, multiply by 900 and divide by 207.8=266.5, the cube root of which gives 6.43 miles per hour.

Another example, of a small boat, 85 feet length, 18½ feet wide, 3¾ feet draft of water, impelled by two engines, pistons 22 inches diameter, 2½ feet stroke, 34 strokes per minute (in 1818). Sectional area 62 square feet; square root thereof 7 87 × 85 feet length÷18½ feet wide=36, which, added to 62, gives 98 to represent resistance. The engines were the earliest construction of combined engines, and probably their pistons did not exert above 7¾ lbs. per square inch*; which would be 30.3 horse power. The boat was sharper than those of the older construction, being very similar in form to those before calculated with 1000 for a multiplier, which being used and ÷ 98 resistance, gives 309, the cube root of which is 6.76 miles per hour. The boat actually went 6⅔ miles per hour.

Another example, of a large vessel, 136 feet long, 26 feet wide, 12½ feet draft of water. Impelled by two engines rated at 60 horse power each, she went 8½ miles per hour, 1825. Sectional area 227 square feet; square root 15.07 × 136÷26=78.8 to be added to 227, making 305.8 to represent resistance. The pistons 43 inches diameter, 4 feet stroke, 26 strokes per minute, exerting 11¼ lbs. per square inch, which is 107½ horse power by each, or 215 horse power exerted by both engines. The form of the vessel was full, such as requires 900 for a multiplier; and 215 horse power × 900÷305.8 gives 633; the cube root of which is 8.59 miles per hour.

The above examples show that the rule applies to cases where the difference of speed is very considerable, as well as the difference of magnitude.

25th April, 1833.

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* Vide note, p. 115.]

VIII. ON THE EFFECTIVE POWER OF THE HIGH-PRESSURE EXPANSIVE CONDENSING STEAM ENGINES COMMONLY IN USE IN CORNISH MINES. BY MR. T. WICKSTEED, CIVIL ENGINEER. COMMUNICATED IN A LETTER TO THE PRESIDENT.

At your request I beg leave to forward you some observations upon Cornish engines, which, although not entering into the detail you seem desirous of obtaining, will not, I trust, be quite devoid of interest.

Having received instructions from the Court of Directors of the East London Water Works to visit the mines in Cornwall, for the purpose of making inquires about the Cornish engines, I left London upon the 1st of August last, and returned upon the 20th of the same month.

My friends, Mr. John Taylor and Mr. Grout, kindly gave me letters of introduction, which enabled me to see any engine I was desirous of viewing.

The first mines I visited were the Wheel Friendship copper mines, near Tavistock, Devonshire, and the Redmoor and Holmbush copper, and the Wheel Brothers silver, mines, near Callington, Cornwall. At the Redmoor mine I saw an engine with a 50 inch cylinder, erected by Messrs. Petherick and West. The mine had not been long at work; the shaft was not more than 156 feet deep; there were two shafts with pumps in, and one was about 560 yards distant from the engine; the motion was communicated by means of horizontal bars, suspended by pendulum rods. The engine was working about two strokes per minute throughout the 24 hours; the work done was light, probably not equal to more than five horses' power; it consumed only three and one-third imperial bushels of coals per 24 hours. The engine had been worked the previous fortnight with turf cut off the neighboring moor, at a cost of eight-pence halfpenny per 24 hours; it required 18 feet square of turf, about 2 inches thick, to keep the steam up for that time. I mention this to show that when a large engine is erected to clear a mine, although in the first instance the work it has to do is not proportioned to its size, nevertheless, the consumption of fuel is nearly in proportion to the work done.

As regards the use of turf, it is evident, as these boilers were constructed with the intention of using coal as fuel, when the depth of the mine and the quantity of water increased, that turf could not be used without an alteration in the fire-places, the bulk of turf required being much greater than that of coal. Mr. Grout has since informed me, that he has ordered an engine and boilers for one of his mines, and that the boilers are to be constructed with a view to the use of turf only.

The next engine that I saw was one at the Fowey Consolidated mines, near St. Blazey. The cylinder was 80 inches, the pump stroke 9½ feet, the duty was, in August, equal to 83,296,000 lbs., raised 1 foot high, with an imperial bushel, or 84 pounds of coals; it consumed about a bushel or 84 pounds of coal per hour. This is a most splendid engine, and does greater "duty" than any other engine in Cornwall; the construction of the valves and other parts of the engine is so perfect, that although its load was equal to about 51,000 lbs., the hand-gear might be worked by a boy of ten years of age, as far as strength was required; I worked it myself with perfect ease; whereas, although the load upon one of our engines of 36 inches cylinder is only about 12,000 lbs., it repuires not only a strong, but also a weighty man to work it.

The hand-gear is all bright work, and finished in first rate style. The quantity of bright work in an engine of course depends upon the taste of the person ordering it, and I certainly saw many Cornish engines of longer standing than the one in question, that displayed very little bright work; but that it can be executed as well in Cornwall as in any other county in England must appear evident to those who have seen this engine, and the founderies or engine manufactories at Hayle. At the latter place I saw an 80 inch cylinder, 12 feet long, in the boring machine, and could not perceive a flaw in it.

I was very much struck with the ease with which the engine in question appeared to work; there was scarcely any noise, the greatest was that of the steam in its passage through the expansive valve. To one who had been used to the noise of the pumping engines in London, it appeared remarkable.

The reason that this engine does more work than any other in Cornwall is, in my opinion, owing chiefly to the construction of the boilers, which are different to the generality, inasmuch as they have an internal tube, of about 21 inches diameter, passing through the main flue of the boiler, extending from the back part of the boiler as far as the bridge of the fire-place, dividing the flame as it passes from the fire-place, and thus where the heat is most intense the surface exposed to its action is greatest; there is also a tube of about the same diameter, and 36 feet long, around which the flue from the boilers passes before entering the chimney; into this tube the feed is sent before it passes into the boilers, and is previously heated to a temperature of 180° by means of the heat that might otherwise pass into the chimney unused.

The engines that I next viewed were the following: viz.

50 inch cylinder	at Charleston,	}	Near St. Austel.
76 Ditto	at East Crennis,		
66 Ditto	at Polgooth,		
85 Ditto	at the Consolidated Mines,	}	Near St. Day.
80 Ditto	at Ditto,		
30 Ditto	at United Mines,		

Although all of these engines were good ones, they were not equal to the Fowey Consols; as regards the last, viz. the 30 inch cylinder, the water that is raised out of the mine by this engine is conveyed by a pipe above ground to suppy a water-wheel; and, although it is small and not of modern construction, it is doing nearly twice the "*duty*" of the London pumping engines of 4 times greater area in the cylinder. I mention this engine particularly, because it is doing precisely the same work that a water-works engine has to do in lifting water into a reservoir.

I afterwards viewed the following engines: viz.

Two 80 inch cylinders	at Wheel Vor, near Helston.	
One 90	Ditto	at North Roskear, near Redruth.
60	Ditto	at South Roskear, near Redruth.
80	Ditto	at Wheel Darlington, near Marazion.
30	Ditto	at Wheel Providence, near St. Ive's.

The 30 inch cylinder at the United Mines, the 80 inch cylinder at Wheel Darlington, and the 30 inch cylinder at Wheel Providence, were raising the water out of the shafts to the *surface*, and I had there-

fore an opportunity of seeing it thrown up, and I observed that in every case there were no bubbles of air mixed with the water, proving that the pumps were lifting "solid" water, (as it is termed in Cornwall,) and not partly water, and partly air, as had been suggested by those who have no faith in the reports of the work done by the Cornish engines.

The foregoing, with the exception of the engine at Wheel Jewel Mines, near St. Day, which was not at work while I wss there, were all the engines that I saw. And before I proceed to make any further remarks upon them, I beg to call your attention to the Table* that accompanies this Report, which gives further particulars of them, extracted from the "Monthly Reports."

As the accuracy of these Reports has been questioned, or to use plainer language, as it has been asserted that they are false, and that the Cornish engines do not perform the work stated, it may be as well to explain how these reports are made.

When the agents of a mine wish the "duty" of their engines to be published, an accurate measurement of the lifts is made and the diameter of the pumps, and other particulars, are recorded; a counter is fixed upon the engines by Capt. Thomas Lean, (the gentleman who had been appointed by the proprietors of the mines to take an account of the work of their engines,) and this counter has a Bramah's lock attached to it, the key of which he keeps. He visits each of the mines once per month, and takes an account of the strokes made by the engines during the preceeding month. In some instances there is another counter attached to the engine, which is open to the inspection of the engineer, agents, and engine-keepers.

The coals are supplied by a distinct party, who has to account to the agent of the mines for the coals consumed per month; the engine-keepers write orders for the coals they require, and at the end of the month the quantity of coals on hand is measured and deducted; the orders are considered as vouchers, which, after having been examined and countersigned by Capt. Thomas Lean, are passed. It is obviously the interest of the coal agent not to report a less quantity than actually is consumed, being accountable for the quantity used; he cannot therefore be supposed to combine with the engine-keepers, whose object, if dishonest, would be to report a less quantity.

But supposing, for the sake of argument, that the engineers, and the agents of mine, were so disposed, and could get these gentlemen to combine with them for the purpose of making a false report, the insanity of such a proceeding will, I think, appear evident upon a perusal of the following statement.

The engines in Cornwall are designed, the drawings made, and the construction and erection of the machinery superintended, by gentlemen who are appointed as engineers to look after the machinery of the mines. The castings are made, and the work designed by the said engineers is executed, at two large "foundries," or engine manufactories, at Hayle.

There are more than twenty engineeers employed in the mines in Cornwall, all of whom are anxious to construct the best engine, as the parties producing the engines that do the best duty, obtain, of course, the most employment. It is therefore a matter of jealous attention on the part of these gentlemen to take care that no engine shall have undue credit for doing the most work. It happens occasionally, where a great improvement has been made, that doubts are expressed as to the accuracy of the reported duty: in such cases the engineers and agents of the other mines call upon the parties whose engine is reported as performing extraordinary duty to allow them to prove it; this call is answered by fixing a time for the trial—the trial lasts for two or three days, during which time the engine is in the hands of the rival parties, who are on the watch to detect unfair play, if any should be attempted. If the result of this trial is favorable, the party in question receives due credit; if otherwise, his character as an honest man is lost. If this is not as severe a test of the accuracy of the reports as can be made, and not sufficient, then indeed prejudice must have its full swing, and no farther *proof* can be given, as gentlemen going into Cornwall from London and elsewhere, for the purpose of proving the truth of the statement made by the Cornish engineers, may with equal justice be charged with making false reports.

The reported "duty" is not necessarily the whole performance of the engine, the amount of which cannot always be obtained; it is, in fact, merely the weight of water lifted, multiplied by the height in feet to which it is raised, reduced to the number of pounds avoirdupoise raised one foot high, for every bushel of coals consumed, without reference to *friction*. Now as the friction of each engine, and the machinery worked by it, varies,—and as, although this friction has to be overcome, the amount of it is not reported, so the reported duty is not the whole performance of the engine: and, consequently, an engine which is reported as performing certain duty may, in fact, be doing as much work as another engine whose *reported* duty is greater.

The pumps in the mines in Cornwall are worked, and the water raised, as the engine goes "out of doors," the force of the steam is employed to raise the heavy pump rods; these rods are in many instances so weighty that without counterbalances, or, as they are termed in the country, "balance bobs," the engine would not be sufficiently powerful to raise them,—for instance, in some cases the pump rods are 150 tons in weight, which is equal to 336,000 lbs. Now the greatest load upon any engine reported in September last, was under 100,000 lbs. It is therefore necessary to have "balance bobs," or beams, one end of which is connected by a rod to the pump rod, and the other is weighted with iron as a counterbalance. These beams are in many instances as large as the beam of a 100 horse Boulton and Watt engine; it is evident that these cannot be worked without friction. In other cases the same engine not only works the pump rods that are in the shaft immediately under the end of the engine beam, but also the pumps in distant shafts, by means of horizontal rods extending in some instances half a mile. These rods are supported either by pendulum rods or work on friction wheels; in these cases the friction must be great. It must also be borne in mind that there is more friction in a small cylinder, in proportion to its area, than in a large one, and, in fact, in all the bearings and working parts of the engine,—the power increasing as the squares of the diameters, while the friction increases as the diameters, directly. There are other sources of friction, but the above examples will be sufficient to prove that, although there appears a discrepancy in the reported duties of the Cornish engines, as *friction* is not taken into the account, it does not *necessarily* follow that an engine, whose *reported* duty is great, should be, in fact, superior to one whose *reported* duty is less.

In addition to this, the *reported* duty, of the same engine doing the same work, may vary 7 or 8 per cent. at different times, merely in consequence of the different quality of the coals supplied.

(To be continued.)

* This "Table of the work performed, &c., in January, 1835," is omitted.

RAPPAHANNOCK CANAL & SLACK WATER NAVIGATION.

NOTICE TO CONTRACTORS.

SEALED Proposals will be received until the 7th day of April next, by the subscriber, on behalf of the Rappahannock Company, at the office of their Engineer, in the Town of Fredericksburg, for the construction of four new dams, raising, covering and backing several others, several short canals, 14 new lift locks, of wood and stone combined, 10 guard locks, and other incidental works, for that portion of the Slack Water Navigation extending from the town of Fredericksburg to Barnett's Mills, a distance of 20 miles.

The prices for the work must include the expense of materials necessary for the completion of the same, according to plans and specifications that will be ready for examination on the 1st to the 7th April, inclusive.

The works to be completed by the 15th day of November of the present year.

It is believed that the work above offered for contract presents superior inducements, especially to such as have been accustomed to, and prefer contracts embracing heavy dry walling and carpentry, the materials of which are at hand and in abundance.

No fears need be entertained as to the healthfulness of the climate. The usual testimonials of character and responsibility will be expected to accompany the proposals.

P. MARTINEAU, Chief Eng.

March 18, 1337. 12—3t

AN ACCOUNT OF SOME EXPERIMENTS MADE IN 1823 AND 1824, FOR DETERMINING THE QUANTITY OF WATER FLOWING THROUGH DIFFERENT SHAPED ORIFICES. BY BRYAN DONKIN, ESQ., F. R. A. S., V. P. INST. C. E.

[The plates of this article are omitted until a subsequent number.]

The apparatus employed in these experiments having been made for a different purpose than that of merely ascertaining the quantity of water discharged, occasioned the peculiar form which is here described.

A, in Fig. 1, Plate ——., represents a vertical copper pipe of $3\frac{3}{8}$ inches interior diameter.

B, a horizontal pipe of the same diameter, joined to the lower end of *A* by what is usually called a mitre joint.

C, another pipe, joined to *B* in a similar manner, but so contrived that it could be turned up or down into a vertical or horizontal position.

Fig. 2 represents the outer end of the pipe *C*, with a cap, *D D*, fitting closely upon its outer side, and capable of being put on or taken off at pleasure; upon the end of cap *D* the ring *d d* was soldered, being about $\frac{1}{4}$ inch wide; this cap was employed for securing the different shaped orifices to the pipe *C*. For instance, where the efflux of water through an aperture in a thin plate of metal was intended to be tried, the cap was taken off, and a circular plate *e e*, of a corresponding diameter to that of the exterior of the tube *C*, was applied to the end of *C*, and the cap *D D* put over it to secure it in its place.

To guard against any leakage of water between the joinings of the cap, the pipe, and the plate, the joinings were filled with a soft cement made of tallow and bees' wax.

Upon the upper end of the pipe *A*, a copper cistern, *E*, was fixed. This cistern was about 2 feet diameter and 6 or 7 inches in depth; the length of the pipe *B* was 10 feet; of *C* about 1 foot 9 inches, and of *A* about 25 feet, measuring from the top of *E* to its junction with *B*.

The water was supplied from a circular cistern, *F*, of 6 feet $7\frac{1}{2}$ inches diameter, and 2 feet 10 inches in depth, by means of a sluice *f*, and the trough *g*.

During each experiment a man was placed to regulate the sluice, so as to keep the cistern *E* always full. And in order to ascertain the quantity of water discharged, a float with a graduated stem was placed in the said cistern *F*.

On the 28th of November, 1823, the following experiments were made in the presence of Professor Barlow, of Woolwich.

To the end of the pipe *C*, the conical pipe *G*, was applied, by having a thin plate, *h*, soldered to it; the opening at the smaller end, which was $\frac{1}{4}$ inch in diameter, and that of the large end $2\frac{1}{2}$ inches diameter, and its length 12 inches; the discharge took place from the larger end of the cone, whilst the pipes *C* and *G* were in a vertical position; the height of the column of water from its surface in *E*, to the upper end of the cone *G*, was 22 feet 9 inches. In 4 minutes it discharged 12·25 cubic feet of water, being at the rate of 3·0625 cubic feet per minute.

2d Experiment.—The conical pipe was inverted so that the discharge took place from the smaller end; in 4 minutes the discharge was 12·5 cubic feet, or at the rate of 3·125 cubic feet per minute.

3d Experiment.—The conical pipe was removed, and a thin plate with a hole $\frac{1}{2}$ an inch in diameter in its centre was applied to the end of the pipe *C*, the height of the column being 23 feet 3 inches; in 4 minutes the discharge was 8·2 cubic feet, or at the rate of 2·05 cubic feet per minute.

Nov. 29. The pipe *C* and the cone *G* were placed horizontally, with the smaller end of the cone outwards, and a column of 26 feet; in 8 minutes it discharged 26·8 cubic feet, being at the rate of 3·35 cubic feet per minute.

Dec. 1st. Pipe and cone horizontal, the larger end outwards, and 26 feet column; in 5 minutes discharged 15·4 cubic feet, or 3·08 cubic feet per minute.

Another experiment was continued for 8 minutes, and the discharge was at the rate of 3·09 cubic feet per minute.

Dec. 5. Two conical pipes, *H H*, each of which was of the same dimensions as the one above described, were united at their smaller ends, and applied to the pipe *C*; in 10 minutes the discharge through the double cone was 48 cubic feet, or at the rate of 4·8 cubic feet per minute, the column of water being 24 feet 3 inches.

A second experiment on the same day was made with a thin plate, having a $\frac{1}{2}$ inch hole through it, and a column of 24 feet 3 inches; in 10 minutes the discharge was 20·6 cubic feet.

In a third experiment, the double cone was tried again, and the discharge obtained was 47·4 cubic feet in 10 minutes.

Dec. 8. The 2 conical pipes last mentioned were separated, and joined together at their larger ends, as at *J J*; in this form a discharge of 20·8 cubic feet of water was obtained in 10 minutes, under a column of 24 feet 3 inches.

Dec. 12. The thin plate with a $\frac{1}{2}$ inch hole was again applied under a column of 24 feet 3 inches, and during 10 minutes discharged 20·75 cubic feet.

Same day. The single cone with the small end outwards, in 10 minutes discharged 32·2 cubic feet, and with the large end outwards, 29·7 cubic feet in the same time, under a head of 24 feet 3 inches.

Same day. The double cone united at their smaller ends, produced a discharge of 46·5 cubic feet in 10 minutes, and in 5 minutes 23·5 cubic feet.

June 8th, 1824. The discharge through the $\frac{1}{4}$ inch round hole in the thin plate during 15 minutes, was 31·75 cubic feet, under a column of water of 24 feet 4 inches high = 2·116 cubic feet per minute.

June 9. Through the same hole, and under the same column, the discharge was 42 cubic feet in 20 minutes;=2·1 per minute.

Through a round hole $\frac{1}{4}$ of an inch diameter, in a thin plate, the discharge was rather less than 16 cubic feet in 30 minutes, under a column of 25 feet $8\frac{1}{2}$ inches.

June 10. The $\frac{1}{2}$ inch hole through a thin plate gave a discharge of 65 cubic feet under a column of 25 feet $8\frac{1}{2}$ inches in 30 minutes, at the rate of 2·166 cubic feet per minute.

The single cone, with the smaller end outwards, delivered 58 cubic feet in 18 minutes, under a head of 25 feet $8\frac{1}{2}$ inches;= 3·22 cubic feet per minute.

On a subsequent day in June. The same experiment repeated, and in 20 minutes the discharge was 63·33 cubic feet;=3·166 cubic feet per minute. In this experiment, the small end of the cone was immersed about 6 inches below the surface of the water during the discharge, consequently the column was 25 feet $2\frac{1}{2}$ inches.

Another experiment on the same day, with the same cone, having its larger end outwards, and immersed seven inches below the surface of the water, discharged 59 cubic feet of water in 20 minutes;=2·95 cubic feet per minute.

The same experiment repeated during 10 minutes, gave a discharge of 29·46 cubic feet, or 2·946 cubic feet per minute.

In another experiment, the double cone joined at the smaller ends, in 18 minutes discharged 84·633 cubic feet under a head of 25 feet 9 inches;=4·7 cubic feet per minute.

Another experiment. The same double cone with its axis 7 inches under water, and a column of 25 feet 2 inches, discharged 56·5 cubic feet in 12 minutes;=4·7 cubic feet per minute.

Agriculture, &c.

From the Baltimore Farmer and Gardener.

AGRICULTURAL JURISPRUDENCE.

We learn from the *Silk Culturist*, that at the late term of the Supreme Court of Errors in Hartford, Connecticut, a question of Agricultural Jurisprudence was settled, which has often been the occasion of much controversy, and sometimes of a total interruption of that social intercourse and interchange of kind feelings and offices, without which, neighborhood ceases to be a blessing, and actually becomes a curse. The question arose in an action of trespass for taking a portion of the fruit from a peach tree. The facts in the case were these.—The trunk of the tree stood about four feet from the division line between the plaintiff and defendant, and its roots and branches extended some distance into and over the defendant's land. The defendant plucked the fruit from the branches overnanging his land, to within one foot of the line, for which the action was brought.

The defendant claimed—

1st. That he was tenant in common with the plaintiff in the tree, and consequently had a right to take from the branches on his side of the line.

2d. That if he was not tenant in common with the plaintiff, he was owner in severalty in that part of the tree which drew its nourishment from his soil, and that he had a right to take the fruit from the branches that overhung his land.

3d. That if he was not the owner of the part of the tree which is sustained by, and overhangs his land, still he was entitled to the fruit growing on such branches.

4th. That he had a legal right to remove

the overhanging branches and projecting roots, they being a nuisance which he had a right to abate.

The court ruled the first three points against the defendant, and decided that the ownership of the tree was in the proprietor on whose land it was originally planted, and that he, of course, was entitled to all the fruit, though the roots and branches may have extended into and over the land of the adjoining proprietor. On the last point the court decided that the projecting roots and branches were nuisances which the defendant might have abated; but that he had no right to appropriate the fruit to his own use.

ILLUMINATED DOOR PLATES.—A person in Philadelphia has invented a new article of the kind, which the United States Gazette describes thus:

"It is formed of very thick glass, ground on the inner surface—on the outer surface is placed the name in metalic letters, fastened with rivets, the plate set in a handsome frame of brass or silver, to suit the other furniture of the door. By day it is a handsome door plate, of the usual appearance; at night the entry lamp makes the name more conspicuous on the outside than it would appear in the sun light. Such a plate would aid the search for a physician's house at night."

Give such hogs as you have in your pen, once a week, a few shovels full of charcoal, or pieces of rotten wood.

From the Farmer and Gardener.

LEGISLATIVE PROTECTION TO AGRICULTURE.

We insert in another part of this day's journal, a very interesting report made in the Legislature of Ohio, on the expediency of encouraging the culture of *Silk* and *Beet*. Though young in years, Ohio is a most powerful State; great in all those physical resources and local advantages, which tend to impart importance to her as a member of the union; the influence of her counsels in giving an impetus to those new branches of American husbandry, cannot, therefore, fail to be of infinite service in putting them upon a footing of solidity, which will place them beyond the reach of contingencies, and plead for their encouragement with a force and fitfulness, that must find its way to the favor of the other legislative bodies of the confederacy.

While *Ohio*, in the West, the first of the new States, is nobly championing the cause of Agriculture, we are gratified to find that *New-Jersey*, one of the gallant old thirteen who so generously aided in breaking the shackles of the mother country, in the war of the Revolution—whose sons during that period of dismay and peril, stood side by side with those of Maryland, and Delaware, in the deadly strife—is actively awake in furthering the good cause—and most sincerely do we join our aspirations with those of the editor of the *Bugle*, expressed in the paragraph below, in the hope, that Maryland will not be slow to follow the lead thus auspiciously set her by her ancient ally—nay, we will go further, and hope, that every other State, whose councils have not already done so, will come to the rescue, with a determination to vie with each other, in the holy rivalry, of doing their respective States the most service

Culture of Silk and Sugar Beet.—In glancing over a New-Jersey paper we accidentally noticed the following among the proceedings in the Legislature of that State on the 7th inst. It evinces an enlightened policy, and sets an example which we hope Maryland will not be slow to follow.—[Kent Bugle.]

Mr. *Mollesson*, after an interesting report in favor of encouraging the culturs of Silk, and Beet Sugar, reported two bills in favor of the same, and 500 copies were ordered to be printed.

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BUCKWHEAT STRAW.

In answer to a question put to us some time since, by "a young Farmer," whether "any use could be made of his buckwheat straw," we replied that it was better for his milch cows than the best timothy hay, that his cows would eat it with equal avidity; that if it had not been too long exposed to the vicissitudes of the weather, it would prove equally nutritious; that so far as the secretion of milk was concerned, it was infinitely preferrable to any hay or fodder within our knowledge, and that if cut and boiled, it would make most excellent slop for his cows. In a conversation with a gentleman from Virginia a few days since, we were happy to find our own opinion and experience confirmed by an anecdote which he related. At the time of thrashing out his buckwheat, he was from home, and contrary to his usual practice, which was to cast the straw into the barn-yard amongst the other *litter*, his hands stacked it in a fold-yard, with his other hay and fodder, where it was accessible to a portion of his cattle. On his return home, he found that his stock had made as free use of the buckwheat straw, as with either his hay or fodder, thus establishing the fact that these animals, which should be admitted to be judges of what suits their own appetites, when left to their own choice, had by their selection of this hitherto neglected food, pointed out a new source of economy to the farmer and planter, which too many have not properly appreciated. Buckwheat as every one knows, can be grown upon almost any soil if planted from the opening of the ground in spring, till the beginning of July, and will not only yield a handsome return of grain, but a full and wholesome supply of as good hay as any agriculturist ever fed his cattle withal.

"Adversity," to use a trite adage, "is the mother of invention," so should the experience of the last few years teach every one engaged in tilling the earth, to husband every means within his power, and of resorting to every resourse within the compass of his ability, to make his stock comfortable, and keep them in plentiful supply of food during the inclemant months of winter. It is the custom of most farmers to sow buckwheat on the poorest spot on the farm, and even when thus treated, often without manure, with no other culture than a ploughing and harrowing, its product is from 20 to 30 bushels to the acre, according to the season. When placed under more advantageous circumstances, on good soil, or land properly manured, it has been known to give a produce of from 60 to 70 bushels to the acre. If then, instead of sowing a small patch merely to afford meal enough for the winter supply of those delightful cakes, which add so much to the luxury of the farmer's winter breakfast table he were to sow from 10 to 20 acres, how much of profit would ensure to him? how much wholesome food would he secure for his cows? and how much solid comfort to all and every thing around him? Than buckwheat grain, nothing is eaten more readily by the poultry and the pigs. For the former, it is the best in winter, largly contributing by the great proportion of lime of which it is composed, to make them lay; for the latter, or for breeding sows, if reduced to meal and boiled into slop, it is at once nourishing and fattening. For sows with young pigs, nothing is more conducive to the secretion of plentiful supplies of milk. And should the straw be cut and steamed, and thus given to milch cows, it would serve as a substitute for other slops, and would materially increase the quantity as well as quality of their milk.

Besides the above uses of this article, if sown early, in the proportion of 2 bushels to the acre, it would bear mowing twice during the season, and would afford most excellent grass for soiling: and beyond all question, there is no green crops that can be turned in with the exception of a clover-ley, that makes so good a dressing for ground for wheat as does buckwheat.

When sown for the grain, from 1 to 1½ bushels to the acre is enough seed.

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NEW-YORK AGRICULTURAL CONVENTION.

The Albany Argus of the 20th instant, contains the proceedings of the State Agricultural Convention of New-York, convened at Albany, the capital of that State, on the 2d inst. *Anthony Van Bergen*, Esq. of Green county, was appointed President, four other gentlemen, Vice Presidents, and the same number, Secretaries.

A series of resolutions were reported to the Convention and unanimously adopted. We shall give an abstract of these with a view of showing their tendency and character. They set forth:

That it is of primary importance to all, that the great branch of agricultural labor should be specially encouraged and honored, and that the agriculturist should himself receive all those mental aids, and that stimulus to industry, which are calculated to make him more prosperous in his business, and more useful to society.

That we are particularly admonished by the scarcity and very high price of all the products of agriculture, to put forth our efforts to alleviate its labors and increase its productions;—That to the Legislature of the State, as the constituted guardians of the public weal, particularly appertains the duty of fostering and improving this primary source of wealth and happiness:—

That from the experience of the past at home and abroad, the Convention are confident, that the patronage of the government may be advantageously exerted, and without detriment to the financial operations of its treasury, to this great object.

1. By so raising the standard of instruction to the children of agriculture, as to enable them to understand, and to apply to productive labor, the best practices and improvements of the age; and

2. By imitating the successful examples furnished to other governments, of calling forth the skill, industry and competition of our citizens, by pecuniary reward and honorary distinction:—

That influenced by these views, the Convention respectfuliy recommend to the Legislature, *to appropriate a permanent fund, the interest of which shall amount to at least* THIRTY THOUSAND DOLLARS A YEAR, *to encourage the establishment, and to sustain in usefulness, a Central and County Agricultural societies,* and to promote generally the interests of husbandry, under such regulations and restrictions as to them shall seem meet, and that provision be made by law for introducing into the common schools of New-York, such books of elementary science, as may be best calculated to accelerate improvements in arts of productive labor.

A memorial, embracing the objects above specified, to the Legislature, was also adopted with equal unanimity.

Among the other resolutions adopted by the Convention, we find the following:

Resolved, That the exhibitions made to this Convention, of *silk fabrics and thread,* made from the indigenous mulberry of our country, affords ample evidence that the silk culture is admirably adapted to our soil and climate, and that nature has bountifully supplied us, should foreign resources fail, with an excellent material for its prosecution.

The Convention before adjourning recommended that another Agricultural Convention be convened in Albany on the first Thursday of February next, and that the several counties in the State take proper measures to be represented therein.

We notice these proceedings with feelings of unmingled pleasure, for every movement of the kind must serve to animate the breasts of the agriculturists of our land with the importance of attending to their own interests; for unless they do so, it must be obvious that no voluntary action will take place on the part of most of those who fill our legislative bodies.

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POLICY OF DESTROYING WEEDS.

There is so much true philosophy, so much sound practical sense, in the following extract from one of Sir Humphrey Davy's lectures, that we cannot omit copying it.

"In all lands, whether arable or pasture, *weeds* of every description should be rooted out *before* the seed is ripe; and if they are suffered to remain in hedge rows, they should be cut when in flower, or before, and made into heaps for manure: in this case they will furnish more nutritive matter in their decomposition; and their increase by dispersion of seeds will be prevented. The farmer, who suffers weeds to remain till their ripe seed are shed, and scattered by the winds, is not only hostile to his own interests, but is likewise an enemy to the public; a few *thistles* will stock a whole farm; and by the light down which is attached to their seeds, they may be distributed over the whole country. Nature has provided such ample resources for the continuance of even the meanest vegetable tribes, that is very difficult to ensure the destruction of such as are hostile to the agriculturst, even with every precaution; seeds excluded from the air, will remain for years inactive in the soil, and yet germinate under favorable circumstances; and the different plants, the seeds of which, like those of the *thistle* and *dandelion,* are furnished with beards or wings, may be brought from an immense distance. The *fleabane* of Canada has only lately been found in Europe; and Linnæus supposes that it has been transported from America by the light downy plumes with which the seed is provided.

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EXPERIMENTS OF VARIOUS MANURES ON POTATOES.

The following extracts from "*Dickinson's Agriculture,*" will show that in Great Britain, particular attention has been given to *salt* as a manure. To show its utility as a manure in a more clear point of view, the following experiments were made by the Rev. Mr. Cartwright.

A certain portion of soil (ferruginous sand brought to a due texture by a liberal covering of pond mud) was laid out in beds one yard wide and forty long: of these, 25 were manured, the first excepted, as follows:

No of Beds.	Kinds of Manure applied.	Product of Potatoes.
1	No manure	157
2	Salt, ¼ peck	198
3	Lime, one bushel	150
4	Soot, one peck	192
5	Wood ashes, two pecks	187
6	Saw dust, three bushels	155
7	Malt dust, two pecks	184
8	Peat, three bushels	159
9	Decayed leaves, three bushels	175
10	Fresh dung, three bushels	192
11	Chandler's graves, nine lbs.	220
12	Salt, lime	167
13	Salt, lime, sulphuric acid	175
14	Salt, lime, peat	183
15	Salt, lime, dung	199
16	Salt, lime, gypsum, peat	201
17	Salt, soot	240
18	Salt, wood ashes	217
19	Salt, saw dust	180
20	Salt, malt dust	189
21	Salt, peat	171
22	Salt, peat, bone dust	178
23	Salt, decayed leaves	187
24	Salt, peat ashes	185
25	Salt, Chandler's graves	195

"The quantity of ingredients the same as when used singly.

On the same day the whole was planted with potatoes a single row in each bed; and that the general experiment might be conducted with all possible accuracy, each bed received the same number of sets.

On the 21st of September, the potatoes were taken up, when the produce of each row was according to the annexed table.

It is observed as being remarkable, that of ten different manures, most of which are of known and acknowledged efficacy, *salt,* a manure hitherto of an ambiguous character, is superior to them all, one only excepted, and that when used in combination with other substances, it is only unsuccessfully applied in union with that one, namely, *Chandler's graves,* no other manure seemingly being injured by it: possibly its deteriorating effects on Chandler's graves may be owing to its antiseptic property, which retards the putréfactive process by which animal substances undergo the changes necessary to qualify them to become the food of plants. This, however, he cannot, from any appearances in the soil when the plants were taken up, assert to have been the case. The extraordinary effects of salt, when combined with soot, he thinks are strikingly singular: there is no reason to suppose these effects were produced by any known chemical agency of soot and salt on each other. Were he to guess at the producing cause, he should conjecture it to be that property of saline substances by which they attract moisture from the atmosphere; for he observed those beds where salt had been used were visibly and palpably moister than the rest, even for weeks after the salt had been applied, and this appearance continued until rain fell, when of course, the distinction ceased. This property of attracting moisture had greater influence possibly, on the soot than on any of the other manures, as soot from its acrid and dry nature may be supposed to require a greater proportion of water to dilute it, than those substances which contain water already. It may be proper to observe, that on those beds where salt had been used, the plants were obviously of a paler green than the rest, though not less luxuriant: a circumstance which he thought worth noticing, and which he considered, though erroneously (as appeared by the event,) to indicate a want of vigor, which would be felt by the crop. It was observable also, that where salt was applied, whether by itself or in combination, the roots were free from that scabbiness which oftentimes infects potatoes, and from which none of the other beds (and there were in the field nearly fifty more than what made part of these experiments) were altogether exempt."

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BURNING SURFACE SOIL AND CLAY.

The following simple and cheap process of burning surface soil and clay, and thus adding to your quantity of calcareous manures and increasing your ability to improve your lands, is very stronly recommended by that eminent English agriculturist, Mr. Curwen. Those living remote from large cities, whence supplies of ashes are usually drawn, and in the neighborhood of lime regions, could in this way, at a very trifling expense obtain ample resources for top dressing their meadows, corn fields, grain fields, and

greatly multiply their ability for raising turnips and root crops generally.

Mounds of seven yards in length, and three and a half in breadth, are kindled with seventy-two bushels of lime. First a layer of dry sods or parings, on which one half of the lime is spread, mixing sods with it, then a covering of 8 inches of sods, on which the other half of the lime is spread, and covered a foot thick; the height of the mound being about a yard.

In 24 hours it will take fire. The lime should be immediately from the kiln. It is better to suffer it to ignite itself than to effect it by the operation of water. When the fire is fairly kindled, fresh sods must be applied. It is best to obtain a considerable quantity of ashes before any quantity of clay is put upon the mounds. The fire naturally rises to the top. It takes less time, and does more work to draw down the ashes from the top, and not to suffer it to rise above six feet. The lime is supposed to add full its worth to the quality of the ashes. Where limestone can be had it would be advisable to burn a small quantity in the mounds, as it would be a great improvement to the ashes, and at the same time help to keep the fire in.

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METHOD OF BURNING LIME WITHOUT KILNS.

The practice of lime-burners in Wales was formerly to burn their lime in kilns, made broad and shallow, but lately they have begun to manufacture that article without any kilns at all.

They place the limestone in large bodies, the stones not being broken small, and calcine these heaps in the same way used for preparing charcoal. To prevent the flame from bursting out at the tops and sides of these heaps, turfs and earth are placed against them, and the aperture partially closed; the heat is thus regulated and transferred through the whole mass, and notwithstanding the increased size of the stones, the whole becomes thoroughly calcined. As a proof of the superior advantage that lime burnt in these clumps has over lime burnt in the old method, a preference is always given to that burned in heaps. This practice also prevails in England and Scotland.

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TANNERS' BARK.

There is much doubt and scepticism prevailing with respect to the relative value of this substance as an improver of the soil. While some contend that it is a cold, inert body, deprived, by the process of tanning of its nutritive properties, others object to it upon the score of its being too heating. Here are qualities ascribed to it as opposite as human opinion can make them; but as it is among the infirmities of his nature for man to err in judgment, may it not be that neither of these opinions are correct. Prejudice too, may have its share of influence in the formation of them, and the truth may be found in the fact that their substance does not possess any one of the qualities here ascribed to it, in any injurious degree, but may in fact combine those which would render it, after being submitted to a judicious chemical process, a highly valuable manure. That the *tanning* principle is extracted no one can question; but in undergoing that deprivation, may it not imbibe other qualities equally conducive to the growth of vegetables? In the tanner's vat, it is placed in close contact with hides, and may it not receive certain portions of animal matter, eminently calculated to advance the healthful nurture of plants?—While in the hands of the tanner, more or less of lime in some of its forms are doubtless imparted to it. This, we know, when combined with earthy matters, or hard woody, fibrous substances, promotes active decomposition, and consequently, the elimination of gaseous particles, which becoming incorporated with the soil, form a valuable part of the pabulum of living vegetables. We are told upon the highest authority that when lime, whether freshly burnt or slaeked, is mixed with any moist, fibrous, vegetable matter, there is a strong action between the lime and the vegetable matter, and they form a kind of compost together, of which a part is usually soluble in water; and that by this kind of operation, lime renders matter which was before comparatively inert, nutritive. Now, may it not be, that all that is wanting to render tanners' bark easy of decomposition, and to convert it into nutritive matter, is the application of a proper portion of lime, or some other substance capable of generating heat? Fermentation once excited, if permitted to go on, would soon convert it into a black vegetable mould. In that state, all would admit its applicability for the production of the food of plants. Rotten tanners' bark mixed with silicious earth, we all know, makes one among the best preparations for the flower bed; indeed we know no mould superior to it; from many years experience we can say that we would prefer it to any other. If then, it was that inert body which some would represent it, it certainly could not gain any thing by its combination with silica to impart to it that principle of active vegetation which it undoubtedly possesses. But let us see what is taken from it in its process of tanning.—The best oak bark, cut at the most auspicious season of the year, contains but 29 parts of the tannin principle out of 480 parts, and surely the abstraction of this minor portion of its whole constituent body, does not materially impair the capacity of the residuum for the purposes of production. But what has been found to be the constituents of this residuum? Why, by a minute analysis of 1,000 parts of dry oak bark, it was found to contain

Of woody fibre	876
Tannin	57
Extract	31
Mucilage	13
Matter rendered insoluble during evaporation, probably a mixture of Albumen and extract,	9
Loss—partly saline matter,	9

It must, therefore, be obvious from this exhibit, that after the separation of the TANNIN principle, there still remains much in the tanners' bark, which may be converted into vegetable nutriment, for of a thousand parts, only fifty-seven are found to combine with, and form a part of, the hides in the process of tanning. The substance abstracted, amounts to less than 6 per cent.; for as the analysis was made by incineration, the *loss* set down should not enter into the account against the residuum. Every one at all conversant with the *constituent properties of manure*, and with the physiology of plants, do know, that the substances which sustain the vitality of growing vegetables must be taken up either in a *liquid* or *gaseous* form, and that the exquisitely delicate ducts of their lymphatic vessels cannot receive any thing solid into them. From these premises, it is fairly deducible that tanners' bark, once reduced to vegetable mould, would be a valuable and healthful manure; the process then, by which it can be *reduced*, becomes an object of importance, and it is equally so, that by admixture with earth and lime, with unrotted horse manure or ashes, its decomposition can speedily be effected. Would it not then, in the absence of other vegetable matter be a valuable substance to spread on all fields where lime was intended to be used, whereon no clover-ley or grass sward existed? It strikes us that it would be; and we recommend its use, from an honest conviction that the happiest meliorating effects would result from it.—Deriving, as tanners' bark do, no little portion of animal matter during the period which it lies in contact with the hides, it may be said to possess both animal and vegetable salts, therefore, must be presumed to be highly forcing in its properties, and, hence, peculiarly adapted to tenacious soils, which may be, naturally, deficient in vegetable matter.

From the New-England Farmer.

MR. FESSENDEN:—If the following remarks are worthy of a place in your useful paper, you are at liberty to publish them, some years since there was a great scarcity of hay. At that time I had on hand a large stock of cattle. Sometime in the month of February my stock of hay was about all gone, and where to obtain more, I could not tell. It could not be had short of 20 miles, and there at the price of thirty dollars per ton.

One day I went to the stable, and no sooner than I entered, every eye was upon me for aid. You may imagine what my feelings were, when I knew of no relief which I could bestow. I stood a while to reflect on what course to pursue, or what to do. At last I thought of some flax which had been lying on the beams of my stable for several years, which had not been rotted. I threw down a few bundles, and gave some of the flax to my cattle. They took hold of it with such eagerness, that I was obliged to take it from them to prevent their being choked with it. I then took a block of wood and a broad axe and chopped it up short. I then gave a very little to my cattle, and continued so to do, until it was all gone.

From what I then discovered of the virtue and oily substance that the flax contained, I am of opinion that what I could take up between my two hands and fingers, after being chopped, and given to a cow each day through the winter, would carry

her through the foddering season. My opinion is that the bulk of one ton of hay in flax, will be of more value to a stock of cattle than four tons of hay. I am also of opinion that oil can be obtained from flax. As I have an oil mill, I intend to try the experimeut the ensuing season. I would recommend to farmers to sow more seed the coming spring than usual; for flax and the seed are of more value than people are aware of. STEPHEN PERLEY.

BY THE EDITOR.—The use of unrotted flax as food for cattle is new to us, and we have never, before we received Mr. Perley's communication, heard or read of its being applied to that purpose. We are of opinion that Mr. P. has made a valuable discovery, and are much indebted to him for its communication.

BEET CULTURE.

INTERESTING CORRESPONDENCE.

We have been favored with the following letter to Mr. Clay, together with Mr. C's. reply.—[United States Gazette.]

PHILADELPHIA, Dec. 19, 1836.

SIR,—Not conversant with the intended movements in regard to the proposed reduction of duties on various articles, but having glanced over the proceedings of congress and noticed that the subject will soon be before that body, and from the remarks on the proposed repeal of duty on Sugar, my mind reverted to that subject in which I have now for a year past, been so deeply interested. My pursuits are mercantile, but I feel that interest for any branch of industry that will benefit the country, that I have, so far as my efforts could avail, done all in my power, and I trust not without success, to introduce and establish in the United States, the culture of the Sugar Beet and the manufacture of Sugar therefrom.

I am aware it is making a great demand upon you, still I wish, most earnestly, to obtain your attention for a moment. I have recently been in a position to meet and become acquainted with Mr. James Pedder, from England, who had for years kept his eye upon the progress of the subject of making some attempt to introduce the same into the United States. I declined at first, persuaded that influence far greater than mine would be needed to introduce the matter successfully to our citizens.

However, deeming "nothing impossible to a willing mind," I proceeded. I introduced Mr. Pedder to our best agriculturists and chemists, and through them to James Ronaldson, Esq. Mr. Vaughan he had already known for several years. Mr. Vaughan, Mr. Ronaldson, and myself, conferred on the subject frequently, in Dec. 1835, and January 1836. I sought and procured such information as I could from the Journals of France and other publications, which was sufficient to decide its practicability, and became evident that it only required a hearty effort somewhere in order to succeed. With a subscription of $50 each from John Vaughan, James Ronaldson and Samuel Richardson, Esqrs., of this city we enabled Mr. Pedder to depart for France by agreement made on the 6th Feb. 1836, (vide his Report) which was entered into with him in the names of Mr. Roalndson, Mr. Vaughan, myself and others, and he departed from New-York on the 10th day of Feb. 1836, furnished with advances and credit on London to prosecute his object even beyond the terms of the agreement, if found requisite and useful. After his departure, every exertion was made to raise donations sufficient to meet the expenses of the undertaking, to INTRODUCE ALL REQUISITE ATTAINABLE INFORMATION, without any intention on our part ever to profit by sugar making. It was thought that a society would aid the thing, and disseminate it more advantagously.

Accordingly, from among the donors, the BEET SUGAR SOCIETY, was organized, but few of its members ever became sufficiently interested to take an active part. This was owing, I suppose, principally to their conviction that the undersigned was so actively engaged in it as to leave little to be done by them, beyond the liberal pecuniary aid which they cheerfully extended. To the active exertions, however, of my worthy colleague, Benjamin M. Hollinshead, complete success, in carrying through our first views, has been secured.

Mr. Pedder wrote to me on the subject, from France, and his letters were published. He returned and made the Report I send you herewith.

About 500 lbs. of seed, from France, have been disseminated through the country from Missouri to Maine.

I visited our State Legislature a few days before they adjourned last session, and though business was pressing upon them, obtained their very favorable notice of our efforts, by a reference (made indeed at an unseasonable time, but unanimous) to the Committee on Agriculture, and the same evening met the committee, who, satisfied, no doubt, of the propriety of the measure, reported next day and recommended an appropriation of three thousand dollars, to be placed in the hands of the Governor, to be applied to the introduction and dissemination of information relating to the manufacture of Beet Sugar and its encouragement, in the State of Pennsylvania.

From a press of business, though this recommendation unanimously passed the Senate, it failed to be noticed in the House, a circumstance, since, most deeply regretted by me, as it would have secured the active existence of the Society organized, and placed in their hands means to have rewarded ingenuity, by premiums, and made successful experiments in the production of sugar from our own soil. Thus left, with a heavy expenditure, and to reimburse the expenses of Mr. Pedder's mission, expense of the seed previously gratuitously distributed, publications, &c., reliance was had upon the well known, but too often taxed liberality of a certain portion of the benevolent and patriotic citizens of Philadelphia.

In this position of things, I have certainly the satisfaction to know, that the exertions, which have not been without labor, have availed much; for I am persuaded that the growing of the sugar therefrom, are destined soon to become parts of the agricultural and mechanical industry of the United States.

Even should no fostering care be extended to it, (such as wisdom and prundence would dictate,) native ingenuity, industry and perseverance, untrammelled by speculative jobbing, or joint stock beet sugar companies and land speculations, will fix it in the United States; and I think it is not going too far to predict that, in the present age, the product of sugar from our own soil, from the beet-root, will supply our own demand, and perhaps more.

France produced last year EIGHTY MILLIONS OF POUNDS OF BEET-ROOT SUGAR! more, by one-third, if I mistake not, than our Louisiana crop of the same period!! What does this not predict with our favorable soil and climate, where, already, this year, from the seed we have distributed, eleven per cent, of good granulated sugar is said to have been obtained from the root which in France yields but six per cent. average, and never over eight? My own observations have not positively verified this, but I am led to believe that it was obtained in the vicinity of Albany, New-York.

From the result of my own experiment (I have had opportunity to make but the one) though from accident my sugar did not granulate properly, I am fully satisfied that 8 per cent. of good sugar for refining, is to be obtained in the United States, from the beet-root.

The growing of Sugar Beet, and manufacture of sugar in the United States, so far as relates to this vicinity, stands thus:—In and about Philadelphia all who are interested (except indeed a few who have this season made and exhibited to me small quantities of sugar better than any I have seen from France,) are waiting to verify the success of others—every man is looking to his neighbor. In other sections of the country the subject has lately been taken up with more spirit. In March last, I received, in an indirect manner, a communication from Mr. M. Isnard of Boston, applying to be engaged in some branch of the manufacturing, by our society, under the impression that its object was the manufacture of sugar. Then, no society had yet been formed.

Informed of the real object we had in view, he turned his attention to excite an interest in Boston. Having had considerable practical experience himself, in all the departments of Beet-root sugar making, from having been engaged in its manufacture in France, he has, by his efforts, contributed to give an impulse to it in the State of Massachusetts.

Joint Stock Companies, Land Speculation, and a variety of ways for making money have been proposed, but none having for its object the true purpose of those engaged in this matter.

Some, disappointed in their visionary schemes of profit from the sudden increased value of land from its introduction, and failing to draw into their plans, those interested, have essayed to disparage the efforts of others whose consciousness of their own motives has been their guide, and to discourage its introduction.

Their success, small as it must be, will not be envied by the well wisher of his country's prosperity.

Herewith, I beg leave to transmit to you a translation of a document published by the Royal Society of Agriculture of France on the subject, which do me the favor to perues

at your earliest convenience and hand over afterwards to my friend Dr. Thomas P. Jones of Washington.

Do not suppose for one moment, Sir, that I have any scheme or plan in which I wish to engage you. I make this communication to you, simply because I have confidence in your large, honorable and patriotic spirit, and I am sure that any good work needs only to be known to you, to secure your approbation and enlist your efforts.

In what ways your assistance is to be rendered, I leave, respectfully and cordially, to your superior wisdom.

I am, with great regard and esteem,
Most respectfully, yours,
JACOB SNIDER, Jun'r.

To HENRY CLAY,
Senator of the United States.

WASHINGTON, 27th Dec. 1836.

DEAR SIR :—I received your favor of the 19th inst., with the paper published by the Royal Agricultural Society of France, on the subject of the manufacture of sugar from Beet. I have read those papers with much attention, and interest, attracted by what I had learnt of the progress of that manufacture in France, and by the patriotic endeavors of yourself and others in Philadelphia, to introduce it in the United States. I took pleasure in distributing some of the Silesian beet seed brought from France last spring, and for which I believe I was indebted to Mr. Ronaldson, and I caused some of them to be sowed at Ashland, my residence. Although it was late in the Spring, they grew very large and were more productive than any other beets which I have ever tried. There was a similar result with all to whom I gave any of the seed. I consider, then, that this important and first step towards the introduction of the manufacture of sugar from beet sufficiently ascertained. There is reason indeed to believe that the climate and soils of our country are better adapted to the growth of beets than those of France.

What is now wanted is a knowledge of, and experience in, conducting the processes by which sugar is extracted from the root. The paper from the French Society, which you have done me the favor to transmit to me, throws much valuable information upon this branch of the subject, and is, I think, worthy of publication and extensive diffusion.

In my opinion, the establishment of the manufature of Beet Sugar in the United States eminently deserves the liberal patronage of government. What, if sucessful, would so greatly redound to the common benefit, ought to be demonstrated by an experiment made at the common expense. For it is the apprehension, incident to all new and untried enterprises that now deter individuals from embarking in this. Owing to the diversity of opinions which exists as to the powers and duties of the general government, which otherwise would be the most fitting to bestow the proper patronage, perhaps an appeal had better be made to the liberality of one of the State governments; and I know of none to which it can be addressed with more propriety than that of Pennsylvania. Fortunately the sum necessary would not be large to make a full and fair experiment.

I have no doubt of the ultimate introduction of the manufacture either with or without the aid of government, and I believe at no distant day a great part of this necessary of human life will be derived from this new source. If we are to credit the authentic evidence obtained from the experience of France, the manufacture of sugar from beet is less costly than from cane.

Ought we not to admire, and to be profoundly penetrated with gratitude for the providential care which, at a moment when, from various causes, the supply of this necessary article is likely to prove inadequate to consumption, opens a new and boundless source, assuring the poor as well as the rich, in all times and in all countries, of an indispensable article of subsistence?

I beg you to accept my individual thanks for your valuable agency in bringing about the naturalization among us of this new manufacture.

I am, with great respect,
Your ob't servant,
H. CLAY,

JACOB SNIDER, Junr. Esq. Philadelphia.

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10 10t

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Engines only will be furnished, or accompanied with *Boilers* and the necessary *Machinery* for putting them in operation, and an Engineer always sent to put them up.

Information will be given at all times to those who desire it, either by letter or by exhibiting the Engines in operation in this city.

Inquiries by letter should be very explicit and the answers shall be equally so.

D. K. MINOR,
132 Nassau-st., New York.

TO ENGINEERS.

WE are gratified to be able to announce to those desiring INSTRUMENTS, that Messrs. E. & G. W. BLUNT of this city, are now prepared to furnish at short notice, LEVELS, from different manufacturers, among others from Troughton & Sims, which they warrant of the first quality. Circumferentors, Levelling Staves, Prismatic Compasses, Mathematical Instruments, Books for Engineers, etc. constantly on hand.

One of the above firm is now in England superintending the manufacture of Theodolites, Transit Instruments, etc.—and any orders for Instruments, not now on hand, will be forwarded him, and executed promptly.

*** Orders will be received and promptly attended to by the Editors of this Journal. 9 4t

AN ELEGANT STEAM ENGINE AND BOILERS, FOR SALE.

THE Steam Engine and Boilers, belonging to the STEAMBOAT HELEN, and now in the Novelty yard, N. Y. Consisting of one Horizontal high pressure Engine, (but may be made to condense with little additional expense) 36 inches diameter, 10 feet stroke, with latest improved Piston Valves, and Metallic packing throughout.

Also, four Tubular Boilers, constructed on the English Locomotive plan, containing a fire surface of over 600 feet in each, or 2500 feet in all—will be sold cheap. All communications addressed (post paid) to the subscriber, will meet with due attention.

HENRY BURDEN.
Troy Iron Works, Nov. 15, 1836. 7—tf

RAILWAY IRON, LOCOMOTIVES, &c.

THE subscribers offer the following articles for sale.

Railway Iron, flat bars, with countersunk holes and mitred joints,

						lbs.
350 tons	2½	by	¼,	15 ft in length,	weighing	$4\frac{68}{100}$ per ft.
280 "	2	"	¼,	"	"	$3\frac{50}{100}$ "
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with Spikes and Splicing Plates adapted thereto. To be sold free of duty to State governments or incorporated companies.

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Rail Road Car and Locomotive Engine Tires, wrought and turned or unturned, ready to be fitted on the wheels, viz. 30, 33, 36, 42, 44, 54, and 60 inches diameter.

E. V. Patent Chain Cable Bolts for Railway Car axles, in lengths of 12 feet 6 inches, to 13 feet 2¼, 2¾, 3, 3¼, 3½, 3¾, and 3¾ inches diameter.

Chains for Inclined Planes, short and stay links, manufactured from the E. V. Cable Bolts, and proved at the greatest strain.

India Rubber Rope for Inclined Planes, made from New Zealand flax.

Also Patent Hemp Cordage for Inclined Planes, and Canal Towing Lines.

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Mr. Solomon W. Roberts, a highly respectable American Engineer, resides in England for the purpose of inspecting all Locomotives, Machinery, Railway Iron &c. ordered through us.

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Locomotive Steam-Engines and Tenders; Driving and other Locomotive Wheels, Axles, Springs and Flange Tires; Car Wheels of cast iron, from a variety of patterns, and Chills; Car Wheels of cast iron, with wrought Tires; Axles of best American refined iron; Springs; Boxes and Bolts for Cars.

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Of all descriptions and of the most improved Patterns, Style, and Workmanship.

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ALSO—Steam Engines and Railroad Castings of every description.

The collection of Patterns for Machinery, is not equalled in the United States. 9—1y

CROTON AQUEDUCT.

NOTICE.—Sealed Proposals will be received by the Water Commissioners of the city of New-York, until the 22d day of April next, at 3 o'clock, P. M., at their office in the city of New-York, and until the 24th day of April, at 9 o'clock, P. M., at the office of their Engineer in the village of Sing Sing, for constructing a Dam across the Croton River, for the Excavation, Embankment, Back Filling, Foundation and Protection Walls; for an Aqueduct Bridge at Sing Sing, three Tunnels, several large and small culverts, and an Aqueduct of stone and brick masonry, with other incidental work, for that portion of the Croton Aqueduct which extends from the Dam on the Croton to Sing Sing, being between eight and nine miles in length.

The prices for the work must include the expense of materials necessary for the completion of the same, according to the plans and specifications that will be presented for examination, as hereinafter mentioned.

The Work to be completed by the first day of October, 1839.

Security will be required for the performance of contracts—and propositions should be accompanied by the names of responsible persons, signifying their assent to become sureties. If the character and responsibilities of those proposing, and the sureties they shall offer, are not known to the Commissioners or Engineers, a certificate of good character, and the extent of their responsibility, signed by the first judge or clerk of the county in which they severally reside, will be required.

No transfer of contracts will be recognised.

Plan of the several structures and specifications of the kind of materials and manner of construction, may be examined at the office of the Commissioners, in the city of New-York, from the 10th to the 14th, inclusive, of April next. The line of Aqueduct will be located, and the map and profile of the same, together with the plans and specifications above mentioned, will be ready for examination at the office of the Engineer, at the village of Sing Sing, on the 15th day of April next, and the Chief or Resident Engineer will be in attendance to explain the plans, &c., and to furnish blank propositions.

Persons proposing for more work than they wish to contract for, must specify the quantity they desire to take.

The full names of all persons that are parties to any proposition, must be written out in the signature for the same.

The parties to the propositions which may be accepted, will be required to enter into contracts immediately after the acceptance of the same.

The undersigned reserve to themselves the right to accept or reject proposals that may be offered for the whole or any part of the above described work, as they may consider the public interest to require.

STEPHEN ALLEN,
CHARLES DUSENBURY,
SAUL ALLEY,
WILLIAM W. FOX,
} Water Commissioners.

JOHN B. JERVIS,
Chief Engineer, New-York Water Works.
New-York, February 28, 1837. 10 5t

TO MANUFACTURERS OF HYDRAULIC CEMENT.

PROPOSALS will be received by the subscriber, on the part of the James River and Kanawka Companies, for the delivery on the wharf, at the city of Richmond, Va., of Fifty Thousand Bushels of Hydraulic Cement. The amount called for must be furnished in quantities of about six thousand, bushels per month, commencing on the first of April and ending on the first of November next.

To avoid future litigation, it is to be understood, on making the proposals, that the bushel shall weigh seventy pounds, NETT, and that the Cement shall be delivered in good ordder, and packed in tight casks or barrels.

Proposals will also be received for furnishing fifty thousand bushels, at any convenient point on the navigable waters of James River, or the north branch of James River, where the materials for its manufacture has been discovered.

Persons familiar with the preparation of the Cement, would do well to examine the Counties of Rockbridge and Botetourt, with a view to the establishment of works for the supply of the western end of the line; and a contract for the above quantities will be made with them before they commence operations.

As there will be required on the line of the James River and Kanawka Improvement, in the course of the present and next year, not less than half a million of bushels of this Cement, and some hundred thousand bushels more in the progress of the work towards the west, contractors will find it to their interest to furnish the article on terms that lead to future engagements.

Proposals to be directed to the subscriber at Richmond, Va.

CHARLES ELLET, Jr.,
Chief Engineer of the J. R. and Ka. Co.
February 20th, 1837. 9 6t

FRAME BRIDGES.

THE undersigned, General Agent of Col. S. H. LONG, to build Bridges, or vend the right to others to build, on his Patent Plan, would respectfully inform Railroad and Bridge Corporations, that he is prepared to make contracts to build, and furnish all materials for superstructures of the kind, in any part of the United States, (Maryland excepted.)

Bridges on the above plan are to be seen at the following localities, viz. On the main road leading from Baltimore to Washington, two miles from the former place. Across the Metawamkeag river on the Military road, in Maine. On the national road in Illinois, at sundry points. On the Baltimore and Susquehanna Railroad at three points. On the Hudson and Patterson Railroad, in two places. On the Boston and Worcester Railroad, at several points. On the Boston and Providence Railroad, at sundry points. Across the Contoocook river at Henniker, N. H. Across the Souhegan river, at Milford, N. H. Across the Connecticut river, at Haverhill, N. H. Across the Contoocook river, at Hancock, N. H. Across the Androscoggin river, at Turner Centre, Maine. Across the Kennebec river, at Waterville, Maine. Across the Genesse river, at Squakiehill, Mount Morris, New-York. Across the White River, at Hartford Vt. Across the Connecticut River, at Lebanon, N. H. Across the mouth of the Broken Straw Creek, Penn. Across the mouth of the Cataraugus Creek, N. Y. A Railroad Bridge diagonally across the Erie, Canal, in the City of Rochester, N. Y. A Railroad Bridge at Upper Still Water, Orono, Maine. This Bridge is 500 feet in length; one of the spans is over 200 feet. It is probably the FIRMEST WOODEN BRIDGE ever built in America.

Notwithstanding his present engagements to build between twenty and thirty Railroad Bridges, and several common bridges, several of which are now in progress of construction, the subscriber will promptly attend to business of the kind to much greater extent and on liberal terms. MOSES LONG.

Rochester, Jan. 13th, 1837. 4—y

NEW ARRANGEMENT.

ROPES FOR INCLINED PLANES OF RAILROADS.

WE the subscribers having formed a co-partnership under the style and firm of Folger & Coleman, for the manufacturing and selling of Ropes for inclined planes of railroads, and for other uses, offer to supply ropes for inclined planes, of any length required without splice, at short notice, the manufacturing of cordage, heretofore carried on by S. S. Durfee & Co., will be done by the new firm, the same superintendant and machinery are employed by the new firm that were employed by S. S. Durfee & Co. All orders will be promptly attended to, and ropes will be shipped to any port in the United States.

12th month, 12th, 1836. Hudson, Columbia County State of New-York.

ROBT. C. FOLGER,
32—tf. GEORGE COLEMAN,

AMES' CELEBRATED SHOVELS, SPADES, &c.

300 dozens Ames' superior back-strap Shovels
150 do do do plain do
150 do do do cast steel Shovels & Spades
150 do do Gold-mining Shovels
100 do do plated Spades
50 do do socket Shovels and Spades.

Together with Pick Axes, Churn Drills, and Crow Bars (steel pointed,) manufactured from Salisbury refined iron—for sale by the manufacturing agents,

WITHERELL, AMES & CO.
No. 2 Liberty street, New-York.
BACKUS, AMES & CO.
No. 8 State street, Albany.

N. B—Also furnished to order, Shapes of every description, made from Salsbury refined Iron v4—tf

A SPLENDID OPPORTUNITY TO MAKE A FORTUNE.

THE Subscriber having obtained Letters Patent, from the Government of France, granting him the exclusive privilege of manufacturing Horse Shoes, by his newly invented machines, now offers the same for sale on terms which cannot fail to make an independent fortune to any enterprising gentlemen wishing to embark in the same.

The machines are in constant operation at the Troy Iron and Nail Factory, and all that is necessary to satisfy the most incredulous, that it is the most VALUABLE PATENT, ever obtained, either in this or any other country, is to witness the operation which is open for inspection to all during working hours. All letters addressed to the subscriber (post paid) will receive due attention.

Troy Iron Works, HENRY BURDEN.

N. B. Horse Shoes of all sizes will be kept constantly for sale by the principal Iron and Hard-ware Merchants, in the United States, at a small advance above the price of Horse Shoe Iron in Bar. All persons selling the same, are AUTHORISED TO WARRANT EVERY SHOE, made from the BEST REFINED IRON, and any failing to render THE MOST PERFECT SATISFACTION, both as regards workmanship and quality of Iron, will be received back, and the price of the same refunded. H. BURDEN. 47—tf

STEPHENSON,

Builder of a superior style of Passenger Cars for Railroads.

No. 264 Elizabeth street, near Bleecker street, New-York.

RAILROAD COMPANIES would do well to examine these Cars; a specimen of which may be seen on that part of the New-York and Harlaem Railroad now in operation J25tf

ARCHIMEDES WORKS.

(100 North Moor street, N. Y.)
NEW-YORK, February 12th, 1836.

THE undersigned begs leave to inform the proprietors of Railroads that they are prepared to furnish all kinds of Machinery for Railroads, Locomotive Engines of any size, Car Wheels, such as are now in successful operation on the Camden and Amboy Railroad, none of which have failed—Castings of all kinds, Wheels, Axles, and Boxes, furnished at shortest notice.

4—vtf H. R. DUNHAM & CO.

PATENT RAILROAD, SHIP AND BOAT SPIKES.

*** The Troy Iron and Nail Factory keeps constantly for sale a very extensive assortment of Wrought Spikes and Nails, from 3 to 10 inches, manufactured by the subscriber's Patent Machinery, which after five years successful operation, and now almost universal use in the United States, (as well as England, where the subscriber obtained a patent,) are found superior to any ever offered in market.

Railroad Companies may be supplied with Spikes having countersink heads suitable to the holes in iron rails, to any amount and on short notice. Almost all the Railroads now in progress in the United States are fastened with Spikes made at the above named factory—for which purpose they are found invaluable, as their adhesion is more than double any common spikes made by the hammer.

*** All orders directed to the Agent, Troy, N. Y., will be punctually attended to.

HENRY BURDEN, Agent.
Troy, N. Y., July, 1831.

*** Spikes are kept for sale, at factory prices, by I. & J. Townsend, Albany, and the principal Iron Merchants in Albany and Troy; J. I. Brower, 222 Water street, New-York; A. M. Jones, Philadelphia; T. Janviers, Baltimore; Degrand & Smith, Boston.

P. S.—Railroad Companies would do well to forward their orders as early as practicable, as the subscriber is desirous of extending the manufacturing so as to keep pace with the daily increasing demand for his Spikes. (1)23am) H. BURDEN.